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Concentrating Plant of the Moose Mountain, Ltd.

By B. B. Hood*

SYNOPSIS—A description of the milling methods at what is probably the largest known magnetic-iron deposit. The ores are tough and some difficulties are encountered in crushing them. Belt conveyors are used to minimize transportation costs. Magnetic separators of the Ball-Norton type are used. The mill is operated by electric power purchased under contract.

Because of the decreasing supply of high-grade hematite more attention is being paid to magnetite as a source of supply for blast furnaces. There are a number of magnetic iron-ore deposits in the world, but in all probability the Moose Mountain, Ltd., operating at Sellwood, Ont., is mining the largest one known. Sellwood is at the end of a 5-mile spur from the main line of the Canadian Northern R.R., and is 35 miles nearly due north of Sudbury, Ont. It is about 80 miles by railroad from Key Harbor, on Georgian Bay, from which point the ore is carried in lake steamers. From magnetometric surveys conducted by the Canadian Government it has been computed that a reserve of more than 150,000,000 tons of magnetic iron ore has been outlined.

Concentrating Plant of the Moose Mountain, Ltd., Sellwood, Ont.

Division of Ore Classes

There are two classes of ore, locally known as types No. 1 and No. 2. The No. 1 ores consist of coarse-grained magnetite, associated, but not intimately mixed, with epidote, hornblende and pyroxene. The No. 2 ores have a fine texture, and the magnetite is intimately associated with silica. The banded structure of these ores suggests sedimentary origin.

The No. 2 ores are far more plentiful than the No. 1, but their preparation for market on a commercial basis is a problem, so that a relatively small amount has been shipped to the furnaces. The No. 1 ores are rather easily concentrated and have been on the market since 1909. While conditions vary, the No. 1 plant may be said to concentrate three tons of ore into two tons of salable product. The accompanying analysis is typical of the concentrates when ready for shipment. They have been crushed to pass the equivalent of 1¼-in. screens and have been passed over 8-mesh screens, the product meeting blast-furnace requirements. They are classed with the nonbessemer Mesabi iron ores.

The No. 1 mill has a maximum capacity of about 1500 long tons of ore per 24 hr. It is near the shaft from which most of the No. 1 ore has been taken. This deposit is nearly vertical and has been mined on such a scale that there is now an openpit about 100 ft. deep, 60 ft. wide and 250 ft. long. The ore is broken from benches into three mill holes, trammed underground to the shaft and hoisted to the mine ore bins. The accompanying drawing shows a flow sheet of the mill as it was being operated in June, 1914, while stocking ore.

ANALYSIS OF CONCENTRATES

	Per Cent.		Per Cent.
Fe	54.35	MgO	3.61
SiO_2	13.94	CaO	3.79
Al_2O_3	1.90	S	0.029
MnO	0.06	P	0.090

Ore Tough and Hard to Crush

Milling this ore is principally a crushing problem, and the present system has been adopted after numerous changes. The ore is hard and tough and has a decided tendency to break into slabs. The slabs do not screen

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readily, so are returned as oversize, tending to overload the oversize-handling part of the mill.

The accompanying photograph shows the mill and town of Sellwood. In front of the mill is the headframe over the shaft. The openpit is just to the right of the picture. Near the center is an old boiler plant, which has since been dismantled, and to the right and back of this are the rock, middlings, dust, and ore bins. The latter are used during the shipping season. A double-track spur runs between them. A conveyor running back toward the town was used at one time for rock, but is now idle. The outer end of the stockpile conveyor is a temporary structure built upon the pile to facilitate the necessary extensions. It was moved about 20 ft. at a time. It shows the effect of settling due to melting of snow in the pile.

The No. 8 Austin crusher referred to in Fig. 1 is not satisfactory for the work, and is only run when it is necessary to make repairs on the Farrel crusher. The first difficulty is that the three openings into the No. 8 crusher will not admit the larger pieces of ore sent up from the mine, while the 36x24-in. machine will take most of them. In addition it is hard to get manganese-steel mantles that will stand the heavy crushing strains. Two of them split before they were worn. The nut holding them down on the shaft was too light and stripped its thread a number of times. It was also caught by large pieces of ore, so that it had to be closely watched to prevent loosening.

Both this crusher and the Farrel machine are belted from a jackshaft which is driven by a 150-hp. motor. Only one crusher is run at a time, the belts of the other being thrown off. The jaw crusher is more satisfactory and gives little trouble. Running at a speed of 250 r.p.m. causes the pitman bearing to overheat unless a spray of water is kept playing upon it. Decreasing the speed to 180 r.p.m., or else supporting the weight of the pitman by a spring, would be as effective as the water spray. Before shutting down the mill in June, which was done on account of the poor iron market, a spring was ordered, but was not installed. If the crusher is adjusted with less than a 4-in. opening at the bottom of the jaws the angle of nip becomes too large; so the opening is usually left a little larger.

Belt-Conveyor Systems

After going through these crushers the ore is fed to a 36-in. belt conveyor running on an incline of approximately 20°. This conveyor carries it to the top of the mill building. A 36-in. Balata belt was tried on this conveyor, but did not prove as satisfactory as the rubber belts. The latter have a $\frac{3}{16}$-in. rubber facing on the top side and $\frac{1}{16}$-in. on the under side. It discharges either into one of two bins or upon a cross-conveyor, which discharges into either of two other bins. These bins hold about 150 tons each, are of wooden construction and discharge into the crushers below through short chutes.

The daily capacity of the mill is limited by the capacity of the No. 5 Austin and three No. 4 McCully crushers, which are set up as closely as possible. They may be said to be doing well when crushing 25 tons of ore per hr. It is usually necessary to be repairing one of these crushers, so that it is safe to count on only three of the four being available at any time. The McCully crushers are driven by 30-hp. motors, and the Austin by a 50-hp. motor. The crushers handle the tough ore well, but trouble is caused by pieces of steel from the mine getting into them. No satisfactory way has been found to utilize magnets to pick these pieces of steel from the ore; consequently the men feeding the crushers have to be on the lookout for them. It is possible that the crushers are a little large for the screens which follow them, which are all revolving, 46 in. in diameter by 6 ft. long, ¼-in. steel plate perforated with 1⅜-in. round holes. The oversize from the screens is about 50% of the discharge from the crushers when they are set up

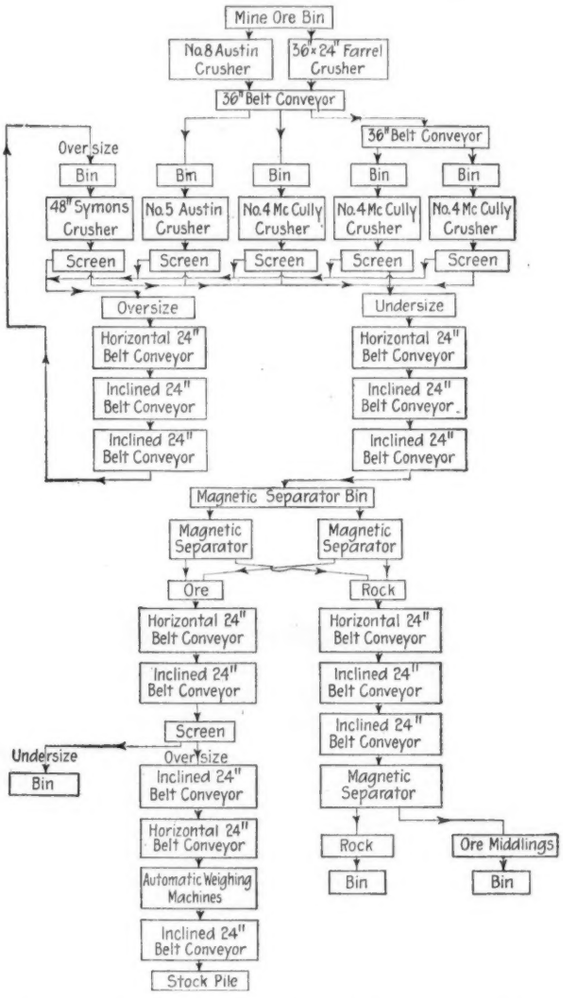


Fig. 1. Flow Sheet of Moose Mountain Mill

as closely as possible. Sometimes conditions are such that the screens return considerably more than 50% in oversize.

Rolls Gave Unsatisfactory Service

For a while the oversize from these screens was elevated by a chain-bucket elevator to a set of 36x14-in. spring rolls. This did not prove satisfactory, as the rolls would give entirely too much oversize on a 1⅜-in. screen when set to nip the largest piece that would come through the crushers. If the rolls were set closer, these pieces would not be nipped and would soon block the feed. At the time of shutting down the mill last June preparations were being made to screen the oversize again over a revolving screen having 2-in. holes. The under-

size was to be fed to the rolls, while the oversize was to go to the Symons crusher. This would allow the rolls to be adjusted so that a large percentage of their product would go through the 1⅜-in. screen.

After the use of rolls was discontinued, the oversize was elevated on belt conveyors running on slopes of about 20°. With the exception of the 36-in. belts previously referred to, all conveyor belts in the mill are 24 in. wide and have a ⅛-in. rubber facing on the wearing side. The oversize is discharged into a bin feeding the 48-in. Symons disk crusher. This crusher is driven by two motors—a 30-hp. and a 50-hp.—which have not sufficient torque to start the crusher in cold weather; but after it is once going they prove satisfactory. This crusher will handle 50 tons of oversize per hr. without any trouble when the disks are set $\frac{7}{16}$ in. apart at the closest place. The screen following it is similar to the others and will return about 25% oversize to the crusher. This crusher withstands remarkably well the destructive action of the steel that gets into it. Never has any part of importance been broken, since the crusher will come to a standstill with the motor fuses blown before breaking. I saw a 2-in. hexagonal nut, fed in with the ore, that had been flattened into wedge shape, with the thinnest part only ⅝ in. thick. When steel does get into this crusher it is usually wedged so tightly that it requires hard work to get it out. It is customary to keep a man watching the feed to pick out steel. The wear and repairs on the crusher were small. It makes not over 15% more dust than the gyratory crushers.

The Magnetic Separators

The undersize from the revolving screens is sent to the separator bins. Each of the magnetic separators has a capacity of 60 tons of ore per 24 hr. They are a modification of the Ball-Norton type, as illustrated in Fig. 2. A base drum revolves about a series of fixed magnets and carries a 24-in. rubber-belt conveyor on which the ore is fed. Each of the magnets extends parallel to the axes and across the face of the drum. They are so wound that opposite poles are adjacent to one another. The nonmagnetic rock is quickly discharged from the belt, while the ore containing magnetite adheres and is carried over as concentrates. The alternate polarity of adjacent magnets causes the magnetic particles to roll over and over when they pass the alternate poles, thus allowing rock which may have been buried under pieces of magnetite to be freed. Twenty-one amperes at 120 volts is the current required to energize each of the separators. A belted motor-generator set is used to supply the necessary direct current. A man stationed at these separators keeps the feed regulated to a uniform depth of about 1½ in. on the belts. The whole concentration is satisfactorily made here in one step by a simple machine. On ore finer than ¼ in. these machines do not separate as cleanly as those of the Wetherill type.

The blast furnaces demand that the dust be taken out of the concentrates; so they are elevated on a belt to a revolving screen of 8-mesh wire cloth, the oversize of which is the salable product. This screen gives considerable trouble in wet weather, since it will readily clog up. Even under dry conditions it is impossible to screen all of the dust from the ore, as the particles attract one another magnetically. From this screen the concentrates are conveyed to an automatic weighing machine.

Automatic Weighing Machine

This weighing machine consists of four receptacles, into one of which the ore is discharged. They are counterbalanced on a lever arm. When about 600 lb. of ore has been discharged into one receptacle, the counterbalancing effect is overcome, allowing the receptacle to drop and another one to take its place while it is discharging. A revolution counter is connected to the lever and records the number of dumps. This machine forms a good check on the milling operation. The daily weights of ore for figuring costs are obtained from the number of skips of ore treated. The principal source of error of the weighing machine lies in the fact that it takes nearly ½ sec. to move and place the next receptacle in position. The ore that comes during this ½ sec. goes into the full receptacle. As the machine is calibrated occasionally by weighing successive dumps,

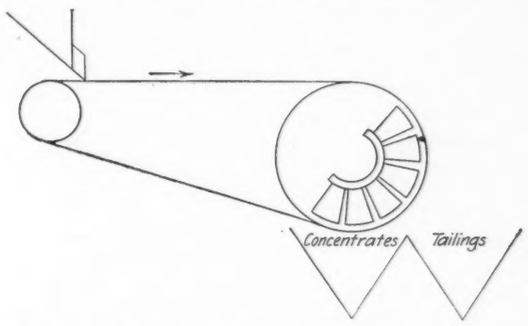


Fig. 2. Modification of the Ball-Norton Separator

this surcharging causes no trouble when the rate of ore coming to the machine remains constant. However, if the rate is increased, more ore gets into each receptacle and the machine will record too low.

During the winter months, until the opening of navigation, the concentrates are taken from the weigher to the stockpile by means of a conveyor belt. Temporary supports for this conveyor rest on the stockpile and the conveyor is lengthened as the pile increases in length. Concentrates from the stockpile in the past have been loaded into cars by means of a magnetic crane, but recently timber drifts were built, on which the pile is accumulated. It is the plan to run belt conveyors in these drifts and load the cars much more rapidly than was possible with the magnetic crane.

Use for Rock Tailings

The rock discarded from the magnetic separators goes over another similar separator equipped with heavier magnetic fields. This picks out a middlings product, which is taken to the No. 2 plant for future treatment. The rock goes to a bin and is hauled away in railroad cars. A market has been developed for this crushed rock, since it is ideal for concrete and road-making purposes. The railroad will take all that is given to it for ballasting its tracks. The dust from the 8-mesh screen is also sent to the No. 2 plant.

The mill is supplied with alternating-current electric power at 550 volts from a transformer station near by. There are 15 motors with a total rating of 525 hp. Power

is furnished to the transformer station at 23,000 volts from a hydroelectric plant 35 miles distant. By the provisions of a contract the power bill for a month is the same as for the previous month, irrespective of how much current has been used, provided that no 20-min. peak is made higher than the highest 20-min. peak of any previous month. If such a peak is made during the month, an increased bill is rendered based on the higher peak, and is rendered for the same amount each month thereafter until the record is again broken. The actual cost for current for May, 1914, was a little under ½c. per kw.-hr. on the switchboard at Sellwood. The power bill is divided among the various accounts at Sellwood in proportion to their full-load motor ratings.

The mill building is a wooden structure, and no heat is provided for the cold winter months. The principal trouble

DAILY COST SHEET OF MILL OPERATIONS, JUNE 12, 1914

(896 Tons of Ore Milled)

Article	Cost	Cost	Cost per Ton
Blacksmith shop	$0.15	....	.....
Machine shop	2.43	....	.....
Manganese parts	....	$13.44	$0.015
Other parts	....	13.44	.015
Conveyor belting	....	26.88	.03
Transmission belting	....	8.96	.01
Power	....	19.00	.....
1½ tons coal	....	7.50	.....
3 ¼x⅜ bushing	....	.06	.....
5 gal. red oil	....	1.35	.....
1 five-gal. oil can	....	.50	.....
2 thirty-two-in. sledge handles	....	.30	.....
160 F. fastener bolts	....	4.80	.....
5 lb. 5-in. nails	....	.15	.....
1 bbl. crusher oil, 40 gal.	....	9.60	.....
5 lb. resin	....	.30	.....
Warehouse expense	....	3.76	.....
	$2.58	$110.04	
		2.58	
Cost today	$2.58	$112.62	.1257
Cost for month to date	14.44	954.45	
Total cost to date	$17.02	$1067.07	

Total tonnage for month to date, 8187 + 896 = 9083
Average cost of supplies, 1067.07 ÷ 9083 = $0.1175

LABOR

	Hours	Pay	Cost per Ton
Millmen	168½	$44.81	$0.0500
Railroad operation for mill	14	5.56	.....
Various belt conveyors	1	.22	.....
	2	.45	.....
	16	4.00	.....
	2	.45	.....
	2	.45	.....
	2	.50	.....
Stockpile belt	2	.45	.....
Belt from screen	2	.45	.....
Shaft, driving belts and pulleys	2	.50	.....
Chutes	2	.50	.....
Mill general	4	1.05	.....
Railroad	1	.25	.....
Mill general M/S	4	.80	.....
Symons crusher	11	3.12	.....
Crusher	1	.20	.....
Motors	16½	4.77	.0265
Labor	243	$68.53	$0.0765
Stores	...	112.62	.1257
Total		$181.15	$0.2022

Tons milled, 896.

FOR CURRENT MONTH

Total tonnage, 8187 + 896 = 9083
Average labor cost, $661.57 + $68.53 = $730.10, = $0.0803 per ton
Average total cost, $1615 + $181.15 = $1796.15, = $0.1977 per ton
The engineer worked 14 hr. and the brakeman 14 hr. There were 7948 ore dumps of the weighing machine and 10 cars of rock.

in operating when the temperature is 20° or 30° below zero is in the inefficiency of the workingmen, due to their extra clothing, and the stiffening of both the conveyor and transmission belts. When extremely cold, motor bearings will start to cut before the oil warms up enough to lubricate them. The greatest operating trouble due to temperature, however, is experienced in the spring and fall when the thermometer stands at about the freezing point. Then the fines of the wet ore will freeze to everything in the mill. The dustiness in warm weather is overcome to a large extent by using a spray of water as the ore is fed to the crushers. A little water is enough, and if this quantity is exceeded the efficiency of the crushers is impaired. This decrease in efficiency is more noticeable on the Symons than on the gyratory crusher.

Mill Operation and Cost

The operating force consists of a mill superintendent, a mill foreman, two shift bosses, four men on the repair crew, four, and sometimes five, men per shift feeding the crushers, one man tending the separators and four men on each shift tending belts and cleaning up. An electrician makes a daily inspection of the motors and the lighting system. The men work 10-hr. shifts. Except during a busy shipping season the mill stops an hour between each shift and at noon and midnight.

Heat Developed in Crushing

An interesting discussion relating to the amount of heat developed in crushing ores has been instituted by James Cook in a paper on the subject in *Bulletin 124* of the Institution of Mining and Metallurgy, Jan. 14, 1914. Mr. Cook was making some experiments in connection with the various methods of calculating the relative energy required to reduce ore to various degrees of fineness, and it occurred to him to ascertain whether the heat evolved could indicate the energy utilized. The accompanying table shows the data accumulated from these tests. Taking the figures in the order tabulated, the following notes show the precautions which were taken to determine the figures as accurately as possible and also to point out the limitations of accuracy.

The weight of the stamps was calculated within a few pounds of the figure used. No deduction was made for their loss in weight during the experiments, which covered a portion of three successive days. The drops per minute were ascertained frequently during the test, but the average height of the drop, which could not be determined continuously, is only approximate. The electrical horsepower put into the motor—the battery being electrically driven—was continually read and the average taken. The "actual" horsepower is merely the product of the estimated weight of stamp and the number and height of drops converted into horsepower. Its accuracy is limited by the difficulty in reading the height of the drop already referred to. The aperture of the commercial screen cloth used was accurately known. The commercial mesh is given first, followed by that of the nearest I.M.M. screening of practically similar orifices. Various meshes were used in order to show whether the heat evolved varied appreciably with the mesh. In the example shown two widely different meshes were selected.

The weight of the water used and the ore crushed was found by two methods—first, by gaging the water feed and the proportion of solid in the pulp sample; and, second, by running all pulp into a measured tank for a certain time, afterward ascertaining the amount of water and solids. Absolute accuracy could only be obtained by having a sufficiently large tank to contain the entire pulp obtained during the test.

The average temperature of the ore feed was ascertained at intervals by burying the thermometer in the

ore chute supplying the automatic feeder. This temperature was practically constant. The average temperature of the water feed was found by frequent tests. After numerous experiments it was found that the best method of ascertaining the pulp temperature was to take large samples from the entire pulp stream into which a thermometer could be inserted and examined undisturbed. The temperature of the building was not sufficiently above that of the pulp or feed to affect the temperature during the time of reading. The same thermometer was used to take all temperatures. This, though somewhat inconvenient, avoided any instrumental error. The thermometer was a sensitive one, divided into tenths of degrees Centigrade, and could be estimated easily to further subdivisions by means of a magnifying glass. The specific heat of the ore was calculated from an analysis to be 0.251, which was confirmed by a rough test in the laboratory.

The product of the pounds of ore crushed per minute, the specific heat, and the rise in temperature in degrees Centigrade, together with the product of the number of pounds of water per minute, its specific heat and the rise in degrees of Centigrade, give the total heat units evolved per minute. This is multiplied by 1390, the number of foot-pounds in 1 pound-calorie[1], divided by 33,000 gives the total horsepower per minute represented by this rise in temperature.

For the original experiments the pulp was graded through I.M.M. screens, as shown in the examples given. Of the electrical horsepower supplied to the motor, it will be seen that only 76% is apparently stored in the raised stamp. The ore crushed will be seen to have been raised an average of 4.8° C., while the water used was raised an average of 0.438° C. The difference is due to the smaller ore feed being at a lower temperature than the water feed. Of the actual electrical horsepower put into the motor, practically 61% is returned as heat in the pulp. Of the energy which reached and was stored in the lifted stamp, practically 80% was returned as heat in the escaping pulp.

[1]The heat necessary to raise the temperature of 1 lb. of water 1° C., usually taken from 10° to 11° C. The figure 1390 is based on the older determinations of the mechanical equivalent of heat. The figure usually given now is 1402, but this alters the calculated values in the text less than 1%.—EDITOR.

Twenty per cent. of energy in the falling stamps unaccounted for as heat may be allocated as follows: A small percentage lost in friction with the guides; a small percentage in sound and vibration; a small loss in radiated heat; and a large amount, possibly the remainder, accounted for by the energy with which the pulp is delivered through the screen. It was found that the screen had at some points a perceptibly higher temperature than the pulp, showing the energetic bombardment to which it was subjected by the particles which were partly returned or passed through. It is a question whether or not the energy used in tearing the ore particles apart is entirely returned as heat. We know that it is so in the agitation of water, and the question has probably been decided by physicists with regard to solids, but it has not been possible to find any definite pronouncement on the subject. Possibly some electrical phenomena may exist.

It will be seen that in the case of the two meshes used a difference in percentage of heat energy of about 3% is given. From other experiments made it appears that this may be regarded as an experimental error within the limitations outlined.

These experiments were not carried to their logical conclusions, due to circumstances which required the author's change to another mine, where no similar crushing appliances existed. A chilean mill was experimented on and no perceptible temperature rise took place while run without ore. This would naturally not be the case with a stamp battery. The ore experimented on was a gold-bearing conglomerate or "banket," but not very similar to the Rand banket in appearance or composition.

In discussing this paper H. Stadler, in *Bulletin 126*, I. M. M., said that it was rather curious that the roughest and clumsiest of all our crushing appliances is the one from which these results have been obtained. The hot pulp discharged by tube mills when working with a low percentage of moisture was for many engineers a temptation to execute similar investigations. Notwithstanding the high-temperature difference between feed and discharge, the experiments were not so successful as those carried out by Mr. Cook with stamps, where conditions are proved to be unexpectedly favorable for such an investigation—first, on account of the

DATA OF EXPERIMENTS ON HEAT DEVELOPMENT

Experiment No.	5	6	7	Average
Battery	5 Stamps	5 Stamps	5 Stamps	....
Weight of stamps in lb.	1300	1300	1300	1300
Drops per minute	103.5	106	103.3	104.27
Average height of drop	7.8 in.	7 in.	7.5 in.	7.43 in.
Hp. at motor	17.12	16.2	16.92	16.75
Hp.—"Actual" from weight stamps × drops per min.	13.25	12.18	12.72	12.72
Percentage actual of motor hp	77.3%	75.2%	75.2%	75.9%
Screen used	12 = 8 I.M.M.	30 = 22 I.M.M.	30 = 22 I.M.M.	....
Lb. ore crushed per minute	44.7	33.8	31.04	36.51
Lb. water used per minute	474	472	405	450
Average temp. C. of ore, feed	22.15	24.2	22.0	22.783
Average temp. C. of water, feed	27.07	27.96	26.51	27.180
Average temp. C. of pulp, dis.	27.483	28.372	27.00	27.618
Diff. temp. ore, feed and discharge	5.333	4.172	5.00	4.835
Diff. temp. water, feed and discharge	0.413	0.412	0.490	0.438
Heat units from ore, S.H. = 0.251	44.7 × 0.251 × 5.333 = 59.83	33.8 × 0.251 × 4.172 = 35.39	31.04 × 0.251 × 5.00 = 38.95	36.51 × 0.251 × 4.835 = 44.49
Heat units from water, S.H. = 1	474 × 1 × 0.413 = 195.76	472 × 1 × 0.412 = 194.46	405 × 1 × 0.490 = 198.45	450 × 1 × 0.438 = 197.10
Total increase in heat units per minute	255.59	229.85	237.40	241.59
Hp. represented by heat units as $\frac{\text{H.U.} \times 1390}{33{,}000}$	$\frac{255.59 \times 1390}{33{,}000}$ = 10.76 hp.	$\frac{229.85 \times 1390}{33{,}000}$ = 9.68 hp.	$\frac{237.4 \times 1390}{33{,}000}$ = 9.999 hp.	$\frac{241.59 \times 1390}{33{,}000}$ = 10.170
Percentage motor hp. returned as heat	62.84%	59.7%	59.09%	= 60.7%
Percentage actual hp. returned as heat	81.2%	79.5%	78.6%	79.95%
Size of ore before milling	— 2 in. + ¾ in. ring	— 2 in. + ¾ in.	— 2 in. + ¾ in.	....
I.M.M. mesh after milling. — 8 + 0	36.12	....	....	....
— 22 + 0	....	5.09	5.02	....
— 30 + 40	6.61	9.11	9.24	....
— 40 + 60	7.87	12.77	14.32	....
— 60 + 100	2.42	13.15	14.95	....
— 100 + 120	5.07	5.08	3.97	....
— 120	41.91	54.80	52.59	....

close contact of water with the crushing part of the appliance in a comparatively narrow and more or less inclosed box, and, secondly, because the bulk of the mechanical loss is liquidated when the potential energy of the lifted stamp is released, after which comparatively small further mechanical loss takes place.

Of the causes mentioned in Mr. Cook's paper to account for the 20% of heat loss which was not definitely accounted for in the rise of pulp temperature, the first was the portion lost in friction with the guides. The frequent breakages of stems in older, carelessly run mills is proof of the great stresses produced in guides and stems by hard lateral thrust at the moment of impact, particularly if the guides are unevenly worn and the clearance of the guides is greater than is absolutely necessary. A regular wear of shoes and dies, as claimed by single stamps, is a good recommendation for a mill design; but the millman can do almost as much on his part by turning the dies from time to time. The idea would be to have short stems now; but it is a question whether conditions could not be improved by more elastic, hollow stems. The reduced weight could be made up by lead cast into high stamp heads.

Loss by Heat Radiation

Stadler believes that the conversion of energy into waves and oscillations is reponsible for the greatest portion of the energy not accounted for as heat. If no ore were fed into the mill a much smaller percentage of heat would be recovered in water; but a correspondingly higher efficiency of the stamps as producers of sound and vibration would result. Mortar boxes with heavy bottoms and in close contact with solid foundations are the natural remedy for such losses. Though not readily perceptible, the radiation of heat is in general one of the principal causes of loss. It is most probable that for this reason the comparatively small amount of heat developed in the adhesive friction of wheels of the empty-running chilean type did not show any appreciable rise in the temperature of water. As the author elsewhere states that the temperature of the building was not sufficiently above that of the pulp or feed, a radiation of heat would, in the case under consideration, rather have acted in the direction of a gain of heat. On the other hand, a correction of the readings to allow for the cooling effect of the water evaporated in the mortar box might have slightly lowered the results. The energy accounted for by the throwing of the pulp through the screen has probably been overestimated and should not even have been mentioned among the losses unaccounted for as heat. The violent agitation of the water here, possibly to its full amount, was converted into heat and accounted for.

Accepting the law of conservation of energy, according to which energy can neither be generated nor destroyed, as an axiomatic truth, it follows that for each heat unit recovered in the pulp, a corresponding equivalent of kinetic energy of the stamp must have been destroyed by the resistance which the ore offered to its elastic and plastic deformation, of which latter rupture is the final stage. The immediate effect of the consumption of energy is the breaking of the ore and the reappearance of the equivalent of this energy in the form of heat. The amount of heat recovered cannot, unfortunately, be taken as a criterion of the useful work done in crushing, because it also includes the heat equivalent of the wasted energy. In includes the head produced by the agitation of the pulp, the friction among the particles, the deformation of the ore within the limits of elasticity, and the energy lost by the rebound of the stamp, which, though accounted for as heat, is lost for the purpose of crushing. The two extreme cases of inefficient working conditions, namely, empty running stamps and a cushioned ore bed, would respectively have just an opposite effect on the rise of temperature. In the first case a smaller and in the second a larger percentage of energy spent would be recovered as heat—in both cases with a reciprocal loss in sound and vibration.

The only essential difference in the working conditions of tests 5 and 6 is the coarser battery mesh used in test 5. The water ratio at 12.3:1 is in all three tests unusually high. Mr. Cook's figures show only a slight difference (1.8%) in the percentage of actual horsepower returned as heat, the difference being in favor of the coarse-crushing stamp. The higher efficiency obtained by calculation from the measurement of the screened product forced out at 9.8%, which figure is in better accord with the experience that the efficiency of stamps increases considerably with the coarseness of the battery mesh. It must here again, however, be remembered that this increase of efficiency refers to grinding to the 200-mesh only, and it would therefore be more correct to say that the inefficiency of stamps increases with the percentage of overdone slime produced within the —200-mesh grade.

Use of Heat Energy

The recovered heat energy is, of course, still further capable of doing useful work. This is actually done, since the rise in temperature has a beneficial effect on chemical affinity and on the rate of settlement of slime. For the realization of these advantages mill pulps are sometimes purposely heated, though generally only when cheap waste heat is available. If direct heating had to be resorted to, as in the case of at least one mine on the Rand—where in consideration of the short life of the mine the capacity of the slimes plant had to be increased without capital expenditure for extension—the money value of the coal required for the production of the 255.6 heat units would be net gain.

R. T. Hancock, in discussing the matter, called attention to the fact that finely powdered dry sand exhibits an appreciable rise in temperature when wetted. It would be a bold man who asserted that the heat thus manifested was part of the energy originally applied in crushing. It is more likely that the phase sand-air possesses more surface energy than the phase sand-water, and it is on these differences according to phase that flotation is based. The phenomenon suggests a possible means of ascertaining the relative fineness of samples of slimes which defy screening analysis. Even without a knowledge of the physical properties involved, comparison might be possible between the slimes produced by two different crushers on the same ore.

Nevada Consolidated Copper Co.

The report of the Nevada Consolidated Copper Co. for the first quarter of 1915 shows a production of 10,815,680 lb. of copper—3,069,919 lb. in January, 3,210,569 lb.

in February and 4,535,192 lb. in March. During the quarter 564,834 dry tons of Nevada Consolidated ore, averaging 1.49% copper, was milled, in addition to 22,483 tons of Giroux ore.

The cost of copper produced, including Steptoe plant depreciation and all charges except ore extinguishment, and crediting all miscellaneous earnings, was 8.97c. per lb. Earnings are computed on the basis of 14.646c. per lb. as the selling price for copper.

There was a surplus of $204,870 for the quarter, after payment on Mar. 31 of the 21st dividend of 25c. per share. There were set aside $100,273 for plant and equipment depreciation and $56,523 for ore extinguishment, leaving a net credit to earned surplus for the quarter of $48,073 and a balance of $2,338,700 in earned surplus. Operating costs were charged with $118,921 for stripping.

New Iron Ranges in Northern Wisconsin

It has been believed for many years that much iron ore would eventually be discovered in northern Wisconsin. The last legislature had sufficient faith in this possibility to provide funds for a survey to ascertain the facts. As a result of the work, the State Geological Survey will soon receive from the state printer the first report, covering a territory of over 2,000,000 acres.

This area is bounded approximately by a line connecting the following towns in the order given: Cameron, Spooner, Hayward, Cable, Morse, Park Falls, Minocqua, Prentice, Phillips, Winter, Ladysmith and Halcombe. Many of the 90 townships surveyed show strong indications of the presence of iron formation—the rock in which iron ore is found—and there will undoubtedly be a large amount of drilling done in this area in the near future, on the basis of the information contained in this report.

Each of the 90 townships is described in plain terms, and definite statements are made as to just which lands show the best indications and which lands are not worth exploring. Each township description is accompanied by a detailed map, about 8 in. square, of that township. This map shows all the railroads, roads, houses, streams, swamps and other features of an ordinary map; and in addition gives the magnetic lines indicating the presence of iron formation, the rock outcrops, and all the detailed readings taken with the dial compass and dip needle.

The report comprises about 400 pages and 91 maps and is sent free to persons forwarding the 20c. necessary to pay for mailing. Address requests to the State Geologist, Madison, Wis.

Electromagnetic Zinc-Ore Treatment by the Campbell Process

By L. E. Ives

As is well known, the zinc ores of the Platteville district, Wisconsin, are readily amenable to treatment by roasting, followed by separation on electromagnetic separators. With this process it is common in that district to make a clean zinc concentrate acceptable to the smelter and an iron-sulphide product. The roasting is usually done in a kiln, the sulphur in the ore furnishing most of the fuel, and the iron sulphide is made magnetic. The product of the kiln is crushed and the electromagnetic separators pick out the magnetic iron sulphide, leaving a clean zinc concentrate, which is shipped to the smelter.

If the ore is given a hot, heavy roast, the result is that the iron product is too low in sulphur to be of value for the sulphur. Its principal use as such would be in the manufacture of sulphuric acid. Moreover, such a hot roast not only magnetizes the iron, but is apt to magnetize some of the zinc, with the result that some of the latter is picked up by the magnets on the separating machines and finds its way to the waste dump.

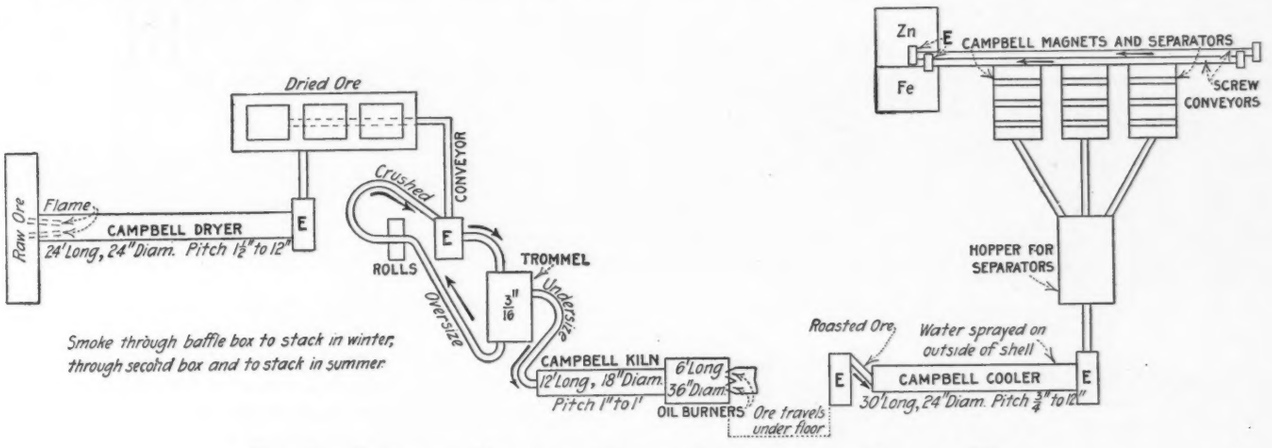


Fig. 1. Campbell Magnetic Blende Concentrator, Linden, Wis.

Within the last few years two plants using the so-called Campbell process and designed to overcome these objections have been erected in the district, at Cuba City and Linden, Wis. The rights and patents to the process and machines involved are controlled by the Campbell Magnetic Separating Co., Boston, Mass.

In the Linden plant the ore is first dried in a revolving sheet-iron drier 24 ft. long and 24 in. in diameter, pitching 1½ in. in 1 ft. toward the discharge end, in which oil fuel, introduced at the feed end, furnishes most of the heat. The dried ore is then crushed to pass a $\frac{3}{16}$-in. trommel. From here it enters a revolving kiln, also sheet iron, 12 ft. long and 12 in. in diameter. In this, however, the oil firing, which furnishes the heat, is from the discharge end of the kiln, which is enlarged to 36 in. diameter for a length of 6 ft. This kiln pitches 1 in. in 1 ft. toward the discharge end.

The roasted ore discharges into a cylindrical, revolving cooler, 30 ft. long and 24 in. diameter pitching ¾ in. in 1 ft. toward the discharge end. The cooling is done by spraying cold water on the outside of this shell. The cooled and roasted ore is elevated to a hopper, from which it feeds by gravity to a battery of electromagnetic separating machines.

The separators have three magnetic fields of different intensities, or, in other words, three magnets. These magnets are transverse to and at regular intervals reach entirely across the surface of the table. The top of the latter is an aluminum plate, pitching rather steeply from head to tail end. Revolving canvas belts pass under each magnet and at a slight distance—a fraction of an inch—from the top of the table. These belts pick up the iron and discharge it at the side of table. The zinc continues to the bottom of the table. Each product is collected in separate bins by screw conveyors traveling under the floor at the foot of the separators. Fig. 1 shows a flow sheet of the plant at Linden, Wis., which is under lease to the Linden Zinc Co. The Cuba City plant is under lease to the Wisconsin Zinc Co.

It is claimed that by the Campbell process—which uses a light roast with the temperature at all times under absolute control due to the oil flame—a high recovery of zinc is obtained, from 92 to 95%; also, that the recovery of the total contents of the ore, zinc, sulphur and iron, is higher, 85 to 90%. Other advantages claimed are great general efficiency, low cost per ton, and a nearly automatic process.

As supporting these claims the figures given in the table may be of interest. They are taken from the books of the Linden plant and show the results of operations during 1914 and for January, 1915.

MAGNETIC CONCENTRATION OF ZINC ORE, LINDEN, WIS.

Month	Raw % Zn	Finished % Zn	Tonnage Raw	Tonnage Finished	Operating Cost per Ton Exclusive of Freight
January, 1914	34.35	60.41	512.5	252.0	$2.48
February, 1914...	33.15	61.04	600	294.5	1.52
March, 1914.....	26.62	59.54	619.32	278.05	1.72
April, 1914.....	22.71	59.15	381	134.31	....
May, 1914.....	27.62	59.00	330.6	145.87	....
June, 1914.....	28.34	58.26	231	97.5	....
July, 1914*.....	21.56	51.07	205	72.25	....
August, 1914*....	21.56	49.05	314	117.2	....
September, 1914..	28.21	52.80	161.5	69.8	....
October, 1914.....	33.55	57.35	341.8	176.25	....
November, 1914..	32.37	59.50	181	86	....
December, 1914...	20.94	59.11	258.25	90.75	....
January, 1915....	28.76	60.00	574.25	251.5	....

*Unusually low-grade ores containing lime sludge.

The labor necessary to operate the Linden plant consists of one man per 12-hr. shift, who unloads the raw ore and loads the finished ore. Between these two points the operation of the plant is automatic.

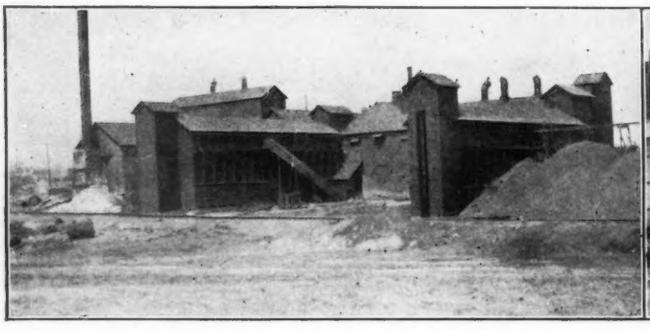


FIG. 2. REAR VIEW, CUBA CITY PLANT

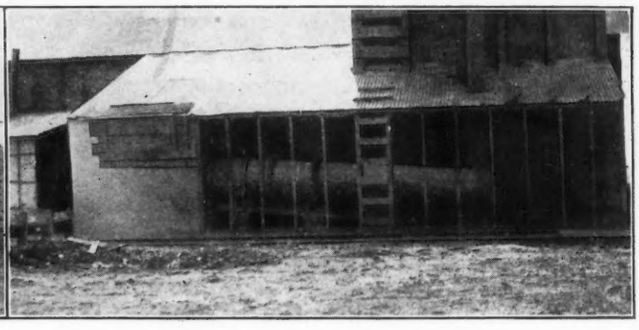


FIG. 3. DRIER FOR RAW ORE

Additions to the Randfontein Plant

A large amount of construction work was done at the Randfontein Central last year, according to the report of C. A. Ferguson, general manager, an abstract of which appears in the *Financial Times,* London, May 5, 1915. At the Porges section an electric hoist of 600 hp. was erected at level 17 to replace the 100-hp. hoist which, as the depth of the shaft increased, became too small in capacity to cope with the work. Two 3400-gal. pumps were installed, one on the 20 and the other on the 21 level. One 3400-gal. pump was also installed on level 19 of the south section and one 8000-gal. pump on level 20. At the north section a 600-hp. electric hoist was erected and the following pumps installed: One 6000-gal. pump on level 15, two 12,000-gal. on level 16, one 22,000-gal. on level 17 and one 22,000-gal. on level 18. At the Robinson section the electrification of the waste-rock elevator was effected and one 22,000-gal. pump and four 12,000-gal. pumps were installed. At the Stubbs section a Fraser & Chalmers 800-hp. Ward-Leonard controlled electric hoist has been installed on the surface in place of the Robey steam hoist and one 12,000-gal. and one 6000-gal. Glenfield & Kennedy pump have been erected on No. 8 level. At the block A section two 12,000-gal. Glenfield & Kennedy pumps have been installed on level 4 and 5-in. Sulzer pumps have been placed on levels 10, 11 and 12.

The capacity of the shaft at this section has been increased by installing larger skips. Four 5-ton skips with Morcom tip and square-tip carriage have been made, and two are in use in the rock-hoist compartments, and, it is stated, are giving satisfactory results. At the Mynpacht section one 12,000-gal. Glenfield & Kennedy pump has been installed at level 8 and a 5-in. Sulzer pump at No. 9 level. Three temporary hoists have been installed for work in the auxiliary shaft—one 35-hp. Holman hoist on No. 7 level, one 30-hp. Holman hoist on No. 8 level and a 6-in. and 7-in. by 12-in. Hornsby hoist on No. 8 level. At the Johnstone section one 12,000-gal. Glenfield & Kennedy pump has been installed on No. 9 level and also one 5-in. Sulzer pump on the same level. At the East Reef section one 6000-gal. Glenfield & Kennedy pump has been installed at level 5. An average of 883 stamps ran 293.921 days last year and crushed 2,493,984 tons of ore. The sand and slime treated amounted to 2,493,924 tons. Working costs averaged 16s. 7d. per ton milled and the yield 23s. 1d. per ton. At the central mill the tube mills have been fitted with Schmidt pebble feeders.

Pressure Ventilating System Used in Cripple Creek Mines

By S. A. Worcester*

SYNOPSIS—Comparison of pressure ventilation with natural draft, blowers and exhauster systems. Explanation of unexpected effectiveness of low-pressure ventilation. Obstacles and difficulties encountered and overcome. Details of construction.

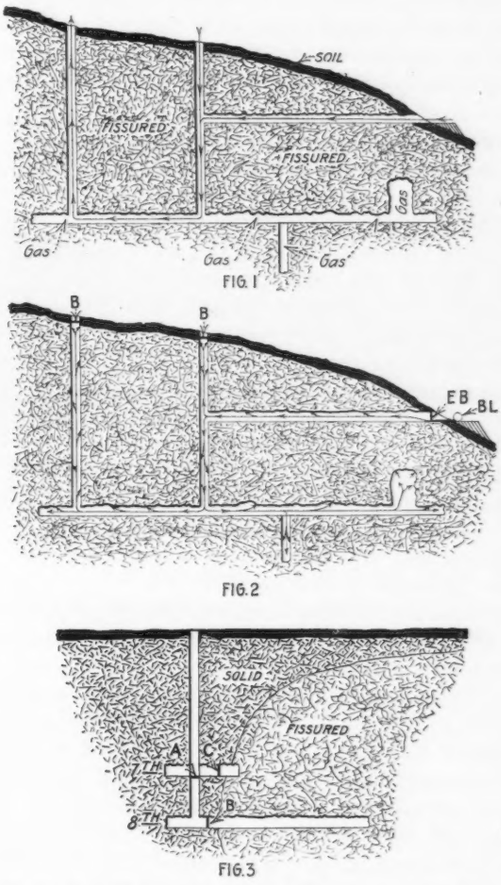
The pressure system of ventilation which I described in the Journal, Jan. 17, 1914, is, in essence, simply the method of sealing or bulkheading the mine practically air-tight and forcing in air under what pressure is necessary to expel mine gas through a fissured formation

The sectional diagram (Fig. 1) illustrates the inefficiency of natural-draft ventilation in workings reached through deep shafts, as are most of the important mines in the Cripple Creek district. If the gas is not too heavy—that is, if it does not contain too much carbon dioxide—a natural draft will usually occur, as shown by the arrows in Fig. 1, in cold weather, and in the reverse direction in hot weather; but, alas for natural ventilation! when the temperature is the same outside as in the mine, there is no draft, and in gassy mines the men lay off and hope for a change of weather. Where, as in the Conundrum, Midget and some of the other mines, the gas in lower levels contains 10% carbon dioxide, it stops all circulation in these levels even in good weather; and even though there may be enough air at the bottom of the shaft to support life, the levels and stopes may be full of gas. As a general rule it is unsafe to work in air too poor in oxygen to support a candle flame, although this rule is too often disregarded, and often with fatal results. Fig. 2 shows by comparison with Fig. 1 how well the pressure method distributes air to all parts of the mine which would normally exude gas. *B* is a stationary bulkhead, *EB* an entrance bulkhead and *BL* a blower.

Entire Mine under Slightly Increased Pressure

I am calling this a pressure system, as opposed to blower or exhauster systems, because it puts the entire mine air under a nearly uniform pressure. A gage applied to the most distant bulkhead at any time shows the same pressure as at the mine entrance. Experience with blower systems has shown that, as a rule, where much gas was present, air forced in by a blower simply passed through the gas without effectively moving it, much as it would pass through water. While exhausters of good capacity have been more successful than blowers, they have the same fault of requiring complete pipe systems, which must be maintained and extended as fast as the mine is enlarged. Success with the pressure system requires some knowledge of its principles and reasonable correctness in details of construction and operation. A preliminary knowledge of the nature of the formation, of the extent and character of the workings, and perhaps of the adjoining territory and workings, is important to success.

A highly interesting feature in the success of this scheme has been the remarkably low pressure which proved efficient in practice in a large number of mines. This pressure has varied from ¼ to 5 in. by water gage, a maximum of less than 3 oz. per sq.in. It is easy to assume—as I did in my first estimate, made for the Moose mine—that mine gas will issue from fissures with a pressure equal to that indicated by the variation of the barometer. This assumption did not take into account any possible outlets on the vein which would give relief and enable a low pressure to expel gas from the mine—hence my first estimate, including two pairs of steel doors, making



Figs. 1 to 3. Mine Sections Showing Natural and Pressure Ventilation

an airlock, with equipment for maintaining a pressure of 1 lb. per sq.in. if necessary. A vital fact is, however, that this district is one great volcanic crater, with innumerable fissures generally connected, and with hundreds of shafts, tunnels, pits and cave-ins giving vent to the atmosphere above. Thus it is that the pressure necessary to ventilate any particular mine is that which will displace the gas, or overcome its specific gravity, without compressing it to any considerable degree. In the Conundrum and Work mines vugs are found as large as the rooms of an ordinary dwelling, and the ventilating current passing out through these places into the crevices is strong enough to blow out a candle. In places in the

*Mechanical engineer, Victor, Colo.

Moose, Midget and other mines the basalt dike is similar to gas coke, and a pick or candlestick can be easily pushed into it. All of the mines having any large quantities of gas have, as a rule, this fissured or porous formation, which is well adapted to assist ventilation by the pressure system. While the highest pressure I personally have used was 3½ in., I was told that at times a 5-in. pressure was used at the plant which I placed in the Empire State mine of the Isabella Mines Co. This is explained by the minute fissures and the lack of any nearby outlet on the vein.

Fissured Formation Essential and an Outlet Desirable

The two essentials to success with this method seem to be, first, a fissured or porous vein formation, and, second, some form of restricted outlet, connecting the vein fissures with the atmosphere, at a distance not too great to give the proper vent. The existence of the first has thus far always implied the existence of the second. The principal outlet, in most cases, has been one or more abandoned shafts in nearby ground. Displacement in the mine being ventilated has the effect of raising the gas higher in the adjoining workings. When the pressure system became effective in the Conundrum mine the adjoining Midget was put out of action, the gas at times being forced out of the mouth of the Midget shaft, while the ventilation at the bottom level of the Conundrum, about 1000 ft. below, was perfect. The Midget management had refused to consider the pressure system, although the lower levels, having good ore, had been abandoned for several years on account of gas. Both the Midget and the Conundrum now use the pressure system, and several nearby abandoned shafts, as a result of the pressure maintained in these two mines, are filled with gas to the surface during working hours.

Difficulties Encountered

It may be helpful to those who are considering the adoption of this method to know what my troubles have been. In most cases I have necessarily depended on my clients for much of my information as to the extent and character of the workings to be ventilated, and this information has too often proved incomplete or misleading. At my first installation, at the Poorman shaft, Anaconda, Colo., I was told that no mine gas had even been known at the seventh level (see Fig. 3), or at the eighth level until it had been extended at least 50 ft. from the shaft. I therefore placed a temporary bulkhead at *A* just below the seventh level while installing the permanent concrete bulkhead *B*, with swing door, on the eighth level. A short time after first applying pressure at *A* the shaft and lower level were free from gas; but gas was soon noticed coming from the seventh and accumulating above the bulkhead in dangerous quantity, showing that the seventh was connected with the fissured and gassy ground. It was necessary to place another bulkhead at *C* before the work at *B* could be continued. After *B* was completed, *A* was removed, leaving the shaft clear for hoisting. After this arrangement had been working nicely for several weeks a machine man neglected to fasten the door open when firing his round. The result was that the first concussion blew the door shut and the second blew it into splinters, and a new door was installed with some difficulty. While the exhaust air from one piston drill would give ample pressure for preventing the entrance of mine gas during working hours, the compressor was a wasteful means of furnishing air when the drill was idle, and I deprecated its use, although the management preferred not to provide the simple and much more economical arrangement advised.

A somewhat similar experience with gas from unexpected places befell the manager of the Little Nell mine some months later. Having little or no gas at the 400-ft. level, but the shaft being full of gas for 150 ft. below, he placed a bulkhead at the 400, with doors allowing the bucket to pass, and with an air-jet injector, through which he forced air under the bulkhead. Going below after a short time, he found all clear at first, but soon began to smell gas, as some experienced miners can do. On coming through the bulkhead he observed that gas was being forced up on the 400 through the fissured vein, so that instead of furnishing fresh air the jet was principally circulating gas through the fissured vein and back through the jet. I was absent from the district at that time, and after having a narrow escape from the gas the manager abandoned further work until my return, when I placed a new shaft bulkhead, with doors, about 15 ft. below the shaft collar. I placed a 5000-ft. fan at the surface, with a wind trunk 20 in. square in section, carrying the air down the manway and through the bulkhead. The fan was driven by a 3-hp. induction motor. Current cost $15 per month when running one shift and $22 when running two shifts. The vein is so loose and fissured and the fan so effective at this mine that 1500 ft. or so of workings is completely cleared of gas in about 10 minutes, although the gas may be pouring out of the shaft, as it often does, when the fan is started. The pressure maintained is less than ½ oz. per sq.in.

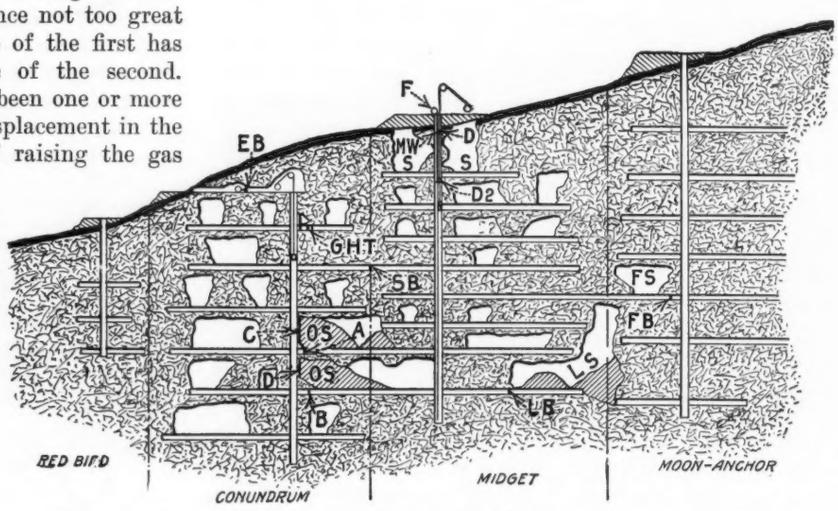


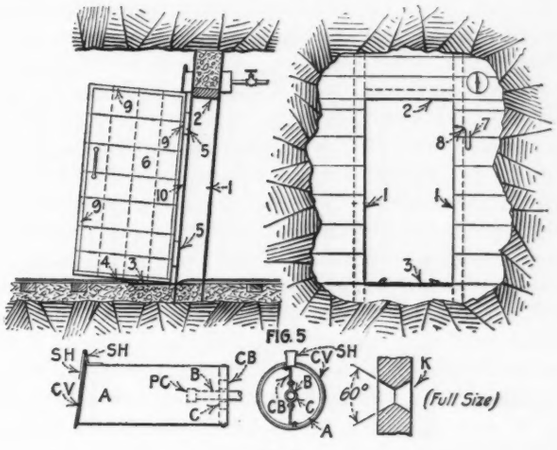
Fig. 4. Section Showing Pressure Ventilation in Several Connected Mines

At the Conundrum mine a short drift connecting the main shaft with the Gold Hill tunnel, *GHT* (Fig. 4), seemed to offer a convenient situation for the steel plate fan and its motor. I was told that no gas was

ever found at this point, and the draft of fresh air from the tunnel portal was unfailing. After the fan had been running effectively at this place for several months the mine air became poor occasionally, so that in very bad weather candles would hardly burn. Gas was found to be issuing from the Gold Hill tunnel and mixing with the air furnished by the fan. Fortunately enough fresh air entered to support life, so that the mixture was not dangerous. This condition was later remedied by cutting a chamber in the Conundrum adit at the entrance bulkhead *EB* (Fig. 4) and moving the fan to that place. The cost for power with a 15-hp. induction motor is from $45 to $60 per month, running about 8½ hr. daily. The fan is sometimes shut down an hour before the end of the shift, and with all doors closed and the check valve on the fan discharges, the gas returns to the mine slowly. The usual pressure is 2-in. water gage. An automatic 3-step starting device, crude but effective, brings the motor to speed in about 15 sec. It is started about one hour before tally, so that no gas is found in the mine when the shift goes down. The fan has a 56-in. blast wheel and its discharge opening is 30 in. square. Its speed is about 340 r.p.m. At the Midget mine the first set of doors tried in the vertical shaft was placed at *D* (Fig. 4), 20 ft. below the shaft mouth, and the manway *MW* was lined with 1-in. boards, which were battened with canton flannel soaked in P. & B. paint. This made a wind trunk extending from the blower through the doorframe bulkhead. On starting the fan very little pressure showed on the gage, and a careful search discovered a number of stopes, *SS,* behind the shaft timbers and connecting in places with the first level and reaching the surface above, but covered by the coarse waste dump to considerable depth. As these immense leaks could not be stopped without great expense, and this level was worked out, the easiest course was to move the doors to *D2,* just below the first level, and extend the wind trunk to this point. When this was done a good pressure was obtained. The fan *F* is a converted steel plate exhauster with one side inlet and is set directly over the manway. It has a 66-in. blast wheel, a discharge outlet 36 in. sq. and a speed of about 400 r.p.m. and is driven by a 20-hp. induction motor.

At the Prince Albert tunnel, about 1400 ft. in length, I was told there was no connected working and no air outlet except the portal. Acting on this hypothesis, I installed an entrance door and bulkhead about 50 ft. in from the portal, and when I commenced to blow with an air-jet injector no sensible pressure was produced. I had noticed a winze, perhaps 100 ft. in from the portal, with water showing about 20 ft. below the tunnel, but did not suspect that this connected with workings. On careful examination I found several hundred feet of drifts at a level about 15 ft. below the tunnel, extending in various directions from the winze, including one drift which extended into a dump of coarse waste at the surface. A muck pile in this drift reached within 2 ft. of the top. I had this piled against the top of the drift and covered with 3 or 4 in. of black soil tightly packed, brought from the surface. After this was done, blowing a few seconds with the air jet raised a pressure of 2½ in.

At the Conundrum mine (Fig. 4) two worked-out stopes, partly filled with fine rock, extend through some distance into the Midget property. The foreman was certain that this stope filling would be air-tight and that bulkheads at *A* and *B* would prevent leakage to the Midget at these levels. When the fan was started the air roared through the fine stope filling like a cyclone. The foreman advised calking with oakum between the round lagging at *C* and *D*. Again giving him the benefit of a doubt, I tried this, but found that while it absorbed immense quantities of the expensive P. & B. paint, it failed to stop leaks. I finally boarded over the entire front of these stopes at *C* and *D,* a distance of about 70 ft., with 1-in. dressed boards, fitting carefully to the foot and hanging walls and battening with canton flannel strips well soaked in P. & B. paint. This made them practically air-tight. Where a level connects directly from one mine to the other, as at *SB,* a permanent bulkhead of 1-in. lumber is built, with the dressed side toward the pressure and two 3x8-in. girts behind, securely wedged in hitches. All loose rock is cleared away at the top, sides, and bottom down to solid, and swept clean. Boards are nailed upright and trimmed so as to fit closely the irregular rock surface. The rocks and the board are painted, and the canton-



FIGS. 5 AND 6. DETAILS OF AIR-TIGHT DOOR IN DRIFT BULKHEAD

flannel strip painted on both sides is stuck over the crack and again painted. Nothing else equals P. & B. paint for this purpose. A doorway 20x24 in. is cut about 18 in. above the level; a trap door, 23x27 in., covers this opening. It must not fit between strips edgewise, so that moisture might make it bind. It must lie flat against the bulkhead, with four thicknesses of canton flannel, nap side out, tacked on in strips 1½ in. wide around the edges where it rests on the bulkhead. A cheap door may be made without hinges and merely held by two buttons. This permits the passage of a man for the purpose of inspecting the bulkhead with a candle. A slight leak, when pressure is on, will give current enough to deflect a candle flame.

DETAILS OF CONSTRUCTION AND OPERATION

Where a worked out stope, *LS* (Fig. 4), partly filled with waste was found, passing from one property into the other, and where a bulkhead at the property line would be expensive, the stope, since it had no value, was simply shut off by placing a permanent bulkhead, *LB,* on the level. Leasers having ground which they desired to work in an adjoining mine, at *FS,* arranged with the Midget to ventilate their workings by placing a bulkhead at *FB.*

They then had their product hoisted through the Midget shaft.

Tunnel Entrance Using Air Jet

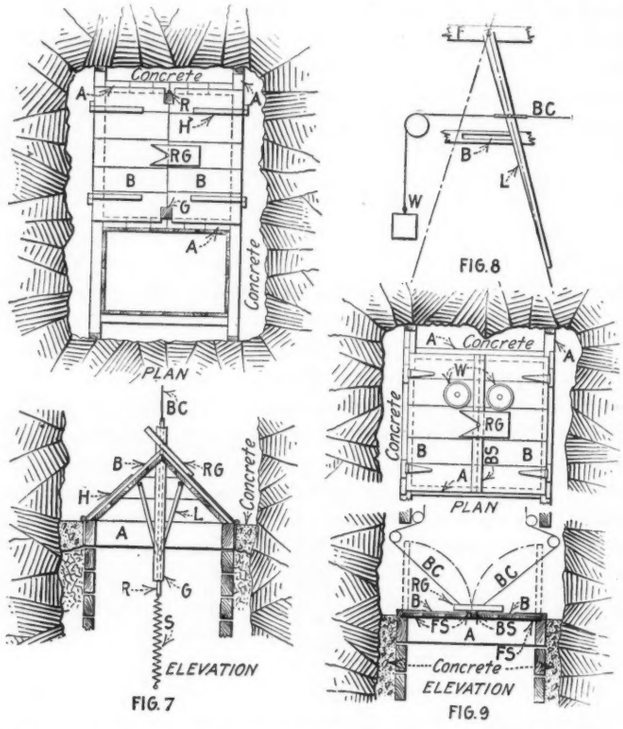
Fig. 5 shows details of an entrance bulkhead for tunnels or drifts using an air-jet injector of crude form for supplying air. Select a place in solid ground, free from cracks or open fissures, and clean away all loose rock at bottom, down to the solid, sweeping clean at the bottom, sides, and top. Then set the 3x10-in. door posts *1*, wedging them solidly in hitches, with the cap *2* spiked between them. Then nail 1-in. boards on the front and back of the posts to a height within ¼ in. of plate *3*. Then nail 1-in. boards horizontally on the front side of the posts and cap up to the top of the drift, trimming with a compass-saw the ends next to the rock to fit the rough surface closely, leaving no opening wider than ½ in. Make mortar of 1 cement to 5 sand by measure, with water enough to show on top after the mortar has settled a short time.

Then fill the bottom of the bulkhead to the height of plate *3*, which should be leveled, embedding many large clean rocks in the mortar, but taking care that they do not touch the form, as that causes voids. Embed the plate in wet mortar, tamping concrete under the edge at 4. The plate is usually 24x¼x36 in., and must fit closely between the posts. After the bottom is filled, nail 1-in. boards singly, smooth side out, on the inside of the frame, filling with mortar and rock as each piece is nailed, and making sure that no voids are left. As the height increases the pressure of mortar on the lower boards increases, and if the drift or tunnel is large, making these boards long, it will be necessary either to brace the unsupported ends or, better still, to run wires through from one side to the other, to prevent bulging. When approaching the top of the bulkhead, the mortar is made drier, and only small rocks, if any, are used, in order to make a good joint and prevent undue shrinkage in drying. The edges where the bulkhead joins the rock should be gone over with clear cement when the bulkhead has set four or five days and all shrinkage cracks closed, particularly around the top, where there is usually some settling. The door, *6*, is made of two thicknesses of 1-in. dressed boards. Two thicknesses of the heaviest canton flannel are placed between the boards and 2-in. nails are used close together and clinched on the pressure side. Clear pine is used. The boards next to the doorframe are horizontal. To prevent twisting, the door should be nailed together on leveled horses or supports.

How the Door Is Made Gas-Tight

Care must also be taken in setting the bulkhead posts to have them "out of wind." The door must not fit between strips or in the frame, but must lie flat on the bulkhead so that the pressure holds it shut and moisture will not affect its fitting. The door laps the opening 1½ in. at the top and sides, and a canton-flannel strip of four thicknesses, 1½ in. wide, is tacked around the door at *9*, where it closes against the frame—that is the 1-in. facing *10*. A 5-in. 4-thick strip is doubled around the bottom edge of the door and tacked on both sides. All of these strips are laid with the nap outward and fastened with carpet tacks spaced about 1 in. apart. The track rails are cut off and the ends tapered down and curved so as to form horns, which rest on the plate clearing the door and guide the wheels of the mine car. The bulkhead is inclined 1 in. per ft., so that the door swings clear of the plate and rails when opening. Ten-inch T-hinges are screwed to the door and to blocks *5*, which are of the same thickness as the door screwed to the bulkhead. The pressure gage *7*, a glass U-tube, is placed at a convenient height on the outside of the bulkhead and connected by a short rubber tube *8* with a nipple passing through the bulkhead. The glass tube is half filled with kerosene. If it is less than ¼ in. inside diameter capillarity will impede its action. It is well to keep this pressure gage in good order, because it indicates any failure of pressure, with the accompanying danger from gas.

The air jet or injector (Fig. 6) includes a short 8-in. galvanized pipe *A*, into which the 1-in. compressed-air pipe *B* projects a short distance. I usually have at hand three different pipe caps, *PC*, with orifices about $\frac{3}{32}$ in., $\frac{3}{16}$ in. and $\frac{5}{16}$ in. diameter. The smallest may be used for ventilating small workings or in good weather, and the



Figs. 7 to 9. Details of Shaft Doors for Pressure Ventilation

others for heavier demands. The $\frac{3}{32}$-in. jet seems to use about as much air as one hammer drill. A check valve, *CV*, of light tin is held by the small strap hinge *SH*, and has four thicknesses of canton flannel held by its turned edge, making a good joint with the wired edge of the pipe *A*. The cross-bar *CB* and clamp *C* supporting the 1-in. pipe centrally are made of 1x$\frac{3}{16}$-in. bar, with ¼-in. stove bolts. The circular jet orifices are reamed as shown full size at *K*, giving a spreading discharge to the compressed air. Any tinner can make this air-jet outfit in a short time, and at small cost. This device is only recommended for temporary use or where compressed air is cheap.

A fan electrically driven is a more economical arrangement in most cases, especially where large volumes of air are needed. The check valve *CV* may be hung up, so as not to impede the air current during the shift, but is dropped to its seat when the jet is shut off and the door

is left closed, with the effect of impeding appreciably the entrance of mine gas to the workings. The end of the pipe *A* is inclined so that the check valve shuts by gravity.

Type of Door for Skip Hoisting

The doors used at the Midget vertical shaft, where a skip is utilized for hoisting, are made of double 2-in. clear pine, with two thicknesses of canton flannel between, and have forged hinges. They are notched to clear the guides and have all seating or meeting edges stripped with four thicknesses of flannel, tacked closely, nap side out. The rod *R*, with links *L*, opens and closes the doors together. The spring *S* assists in starting the doors from the vertical position toward closing, and the steel bell-cord *BC* passes up the shaft, over a sheave to the lever *L* (Fig. 8) with fulcrum at *F*, and is placed within easy reach of the hoist engineer. The weight *W* nearly balances the doors and spring. The parts are held in the open or closed position by hooking the lever *L* over the stationary block *B*. The weight of these doors and connections is sufficient to resist the pressure used at this mine. The rope guide *RG* is bolted to the door and is easily renewable when worn. It directs the rope into the center groove when the doors are closed, preventing it from catching between the meeting edges.

Shaft Doors Used with Bucket Hoisting

When installing these doors (Fig. 9) as used at the Little Nell mine a place was chosen in solid rock 15 ft. below the shaft collar, and enough of the shaft timbering was removed to make room for the frame *A* and for swinging the doors *B* clear of the shaft. The rock was swept clean on all sides, to give a good joint for concrete. The sides of the frame *A* extend through the manway, giving sills for the bulkhead of 1-in. boards. The cracks are battened with the heaviest canton flannel, well soaked and stuck on the freshly painted surface with P. & B. paint, then painted on the back. The frame *A*, being firmly wedged in place and leveled, is concreted all around, using the mortar described in the foregoing. Many large clean rocks are embedded in the mortar, taking care to leave no voids and making the top about 2 in. of clear mortar, with no rocks. The doors *B* are made of 1-in. clear dressed boards, crossed, with two thicknesses of canton flannel between and 2-in. clinched nails spaced closely. They should be free from twist and lie flat on the frame. The frame should be dressed where the doors seat. Canton-flannel strips *FS*, about 1½ in. wide, in four thicknesses, are tacked around the three edges of the doors where they rest on the frame and on the under side of the batten strip *BS*, using carpet tacks about 1 in. apart, with the nap of the flannel outside. The doors are notched at the center to fit the hoisting rope nicely, and the rope guide *RG*, of hard pine, is screwed to the door. The lower boards run lengthwise. Ten-inch tee hinges are used. The weights *WW*, in this case worn-out sheave-wheels, were determined by experiment after pressure on the door, and are bolted to the door. The batten strip is fast to the door having the rope guide, and this door must be opened first and closed last to prevent interference. Cotton bell-cords *BC* are fastened to staples near the edges of the doors and are led by pulleys to handles with hooks within easy reach of the engineer. The doors must not fit edgewise but lie flat, or moisture will make them troublesome.

I have built many fixed bulkheads in shafts and raises by simply stulling and lagging the opening and packing a few inches of black surface soil on top of the lagging. Ordinary mine rock, however fine, seems to leak very much, but black surface soil makes an air-tight stopping when well packed.

The Things We Ought Not To Have Done*

By David H. Browne

There are in the Irish language a great many witty proverbs, some of which you never hear in their English translation. One of these, relating to widows and old maids, will be appreciated. "It's a lonesome washing"—says the proverb—"it's a lonesome washing that hasn't a man's shirt in it."

The two proverbs that have always appealed to me, however, are " 'Come back to me,' says the half-done job"; and "Bought sense is the best sense."

These two are particularly applicable to scientific men —we are always impelled to go back to our half-done jobs. We cannot leave them unfinished. We realize in all our work that the things that really count are the things that we have been taught by experience.

Kipling's Mounted Infantry man sings:

> "I wish myself could talk to myself,
> As I knew 'im a year ago,
> I'd tell 'im a lot 'ud save 'im a lot,
> On the things he ought to know."

To this sentiment every one here will assent. Hindsight is always clearer than foresight. Anyone can see a mistake when it hits him in the shape of cast iron, but it takes a wise man to see that same mistake in a beautiful blueprint.

In looking back over our half-done jobs we are often struck with the way in which we overlooked some point which experience shows us was vital. Too often all our calculations were vitiated by lack of information, or by lack of realization of the importance of some point which at the time received scant attention.

Another thing that strikes us is the way one investigator will duplicate another's work—plodding along a path which some previous experimenter found to lead nowhere. All this lost endeavor is due, as Dr. Johnson said, to "pure ignorance, ma'am; pure ignorance."

It very often happens that success and failure are separated by a very small margin. I remember once our old friend Garnier, in the days of our innocence, was instructing us on the art of refining molten nickel. "You shall get," said he, "a green pole of ze fir tree, a green pole zat shall be perfectly dry, and you shall push him down in ze bath of melted nickel—and ze nickel shall go birr-r-r and ze air shall go through ze nickel and oxidize ze iron and purify ze nickel."

Very pretty in theory, but it did not work out in fact. A few weeks later Garnier returned to France and several of us accompanied him to the station to bid him farewell. With us was the furnace foreman, an Irishman with a hand like a ham and a heart like a child. "Before ye go, Misther Garnier," he said, "I'd like to tell ye something, av ye don't mind—that might interest ye. Ye know,

*A paper read at the C. M. I. meeting, March, 1915.

Misther Garnier, that ye told us to get a furr pole an' put it in the furnace. Now Misther Garnier, in the English language there is three words 'furr'—There is furr that's a furr three, an' there is furr that's furr on a cat, an' there is furr that's to go furr to do a thing. So it may be, Misther Garnier, that owin' to yer ignorance av' the English language we got howld av the wrong kind av a three."

Now the foreman's conclusions were erroneous, but he certainly had the right idea about the importance of little things in metallurgical work.

In all research we are seeking for the truth. We are trying to read the riddles of Nature. To every question there must be an answer, and the more answers we find to be wrong, the greater are the chances of our finding the true solution. I wish therefore to emphasize the importance of failures.

Every metallurgist can look back and recite his confession: "We have left undone those things that we ought to have done and we have done those things that we ought not to have done"; but he will not add, "And there is no health in us," for health in any business means the assimilation of what is suitable and the rejection of what is unfit. So the more we add to our store of information as to the unfit, the faster will be our progress.

Failures Are Not Advertised, Successes Are

The difficulty is, however, to get information about failures. Success stands in the limelight; failure hides behind the screen, and yet success is built on failures. Men as a rule do not publish their mistakes. Inquire about any discarded patent or process. You go to the place where the experiment was made and ask Jones: "Oh, that idea is no good. We tried it in '98. Robinson could tell you all about it." Robinson has moved away, and when you run him down he refers you to Smith, who is dead—information and all.

I suggested last year to the directors of one of the largest copper companies that all smelting plants should coöperate to establish a bureau of unpublished metallurgical research.

Such a mortuary, or metallurgical graveyard, would be a valuable asset. It would save much money uselessly expended. It would keep on file those ideas which, like Jairus' daughter, are not really dead but are waiting for their awakening.

The formation of such a bureau by smelting companies is, however, open to the objection that the data recorded there would not be available to the public, and that as inventions do not always originate with these smelting companies the information would not serve its full purpose.

It might be possible to have our engineering societies, such as the Canadian Mining Institute, the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, act as custodians of information regarding failures or regarding investigations which did not yield practical results.

Let us take an extreme case as an example of this. Some one conceives the idea that the metal contained in slag could be recovered by some process of water concentration or flotation. He does much work on this and obtains a lot of interesting data, but can find no process of which the cost bears a profitable relation to the recovery. He finds, we will say, that some of the metal is there as oxide and cannot be recovered. He gives up his investigation because the idea will not pay. Meanwhile some other man may have worked out a cheap method of converting copper oxide to sulphide, but sees no use in the reaction because the general trend of copper metallurgy is to convert sulphides into oxides and get rid of the sulphur. These two men, brought into mutual relation, are of value to the world. Their work fits together, but individually their labor is useless. Neither hears of the other because each has scored a failure, and failures remain unpublished.

If some scheme were adopted whereby our societies could become repositories of such data, A and B would both deposit their records with the society and the next bulletin would announce that we have received notes on these subjects, and if any one desired information concerning them a brief summary could be forwarded on receipt of a certain fee for stenographers' services. Thus A and B would hear of each other and pool their resources.

In the old days the cry was "Go West, young man, and grow wheat!" Today there are no homesteads to take up and the tide is setting back; the young man is advised to go East and take up an abandoned farm.

Abandoned Farms Exist in Metallurgy

It is just so in metallurgy. The more great advances are made, the less chance there is for such advances to be made. We are driven inward to look for abandoned farms —ideas that were good in themselves but failed because of lack of information or experience. These are the future fields for us to cultivate. The advances to be made in metallurgy today are to be made by intensive cultivation and not by extensive expansion.

Let us therefore formulate some scheme whereby our attention is directed toward these abandoned farms and see how we can make them profitable.

We are too prone to look upon past failures as closed incidents, and to forget the benefits derived in the shape of increased knowledge. We must learn to apply to each debit for failures a credit for experience.

Some years ago I moved into a house which had formerly been occupied by an old country doctor. In the attic I found his account books. In one of these was an account with a clergyman. The left-hand side was filled with items: "To visit, $1.00; to bolus, 25c.; to medicine, 50c.; to plaster, 25c., and so on. The column added up at the foot of the page: "Total, $52.50." On the credit side, under a date two years after, was the entry in red ink: "By Gospel preached to balance this account, $52.50.

The failures we make in metallurgy are debits on our ledgers. I wish to suggest a plan whereby we can cancel them—"by Gospel preached to balance this account."

Spitzbergen Coal Fields

Christiania Correspondence

Owing to the war, the Norwegian syndicate which had sold its rights in Spitzbergen to a Russo-German syndicate for 300,000 roubles ($154,500) and received the first installment of the purchase amount, has had to take over the claims, with a loss to the foreigners of the amount paid. The Stavanger syndicate has now, it is stated, disposed of its rights to a Russian company for a sum of 700,000 kroner ($187,600), but the first installment is not to be paid until after the war.

Details of Practical Mining

Steel and Concrete Mine Houses

The question of mining dwellings is a perennially perplexing one. A late addition to the list of possible types of construction is the Kahn Pressed Steel method as developed by the Trussed Concrete Steel Co., of Youngstown, Ohio. This method uses a pressed-steel frame, the members all fabricated to exact measure and capable of rapid and easy assembly, and correspond to the members used in wood construction. To this frame are fastened sections of Hy-Rib, a well-known type of concrete reinforcement, and on the Hy-Rib cement mortar is plastered for walls, partitions and floors.

The pressed-steel members resemble rolled sections in general, the most common being the channel and I-beam.

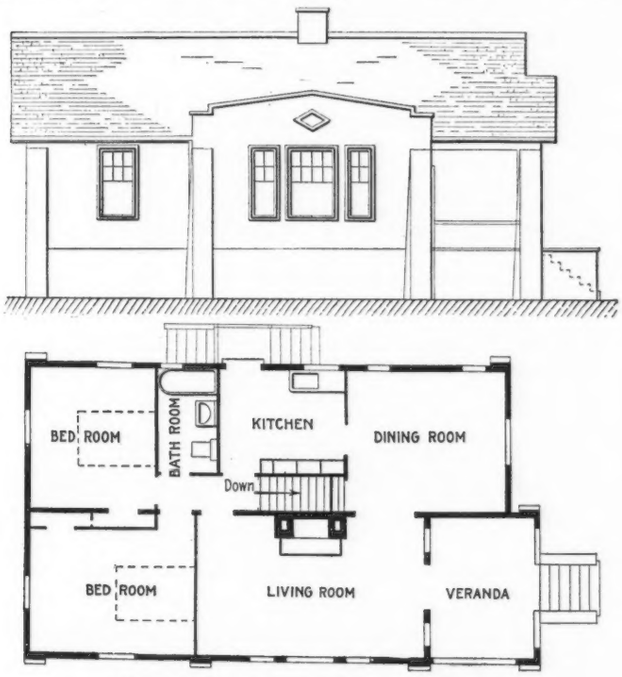


FIG. 1. CONCRETE MINERS' HOUSE

The flanges are doubled back a short way to give additional stiffness. Little tabs of steel are forced out of the flanges at regular intervals and are bradded down over the Hy-Rib to hold it in place. The Hy-Rib not only holds the mortar but also stiffens the frame transversely.

Joints are made by means of a wedge and a "tenon angle." A typical joint is shown in Fig. 2. This is a rapid method of assembly and is supposed to do away with the use of all tools but a hammer. Bolt holes are also provided if it is desired to use bolts.

When a wood floor is wanted, wood nailing strips are nailed along the center of the floorbeams, the latter being I-beams made by riveting two channels together, so that nails can penetrate between the halves. The space between the nailing strips is filled with mortar on Hy-Rib and the wood floor nailed to the strips. A solid concrete floor is not uncommon, and a cement-finished floor on gravel or ashes is available under certain conditions. Steel window frames are recommended, although wood frames are often used. Instead of wood trim inside, cement and steel can be used.

For partitions carrying no weight, light channels are furnished to carry Hy-Rib, or Hy-Rib alone can be used, mortar being applied in the usual manner. These partitions can be made either double or single.

Some of the numerous advantages claimed by the manufacturer will probably occur to the reader. In the first place, houses thus fabricated can be made about as completely fireproof as is possible, and the importance of fireproof construction around the mine is becoming more and more widely recognized. In the second place, great permanency is obtained, and with the 300,000,000-ton-reserve mine growing increasingly common, permanent construction is becoming more desirable from the point of view of the mine operator. Again, field erection is extremely simple and rapid, and as it requires no expert

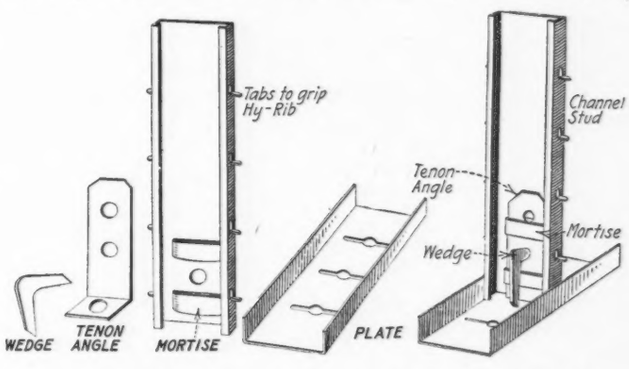


FIG. 2. JOINT FOR REINFORCED-CONCRETE HOUSES

labor it is relatively cheap. As with most concrete construction, protection against vermin and infection is simplified.

It is perhaps questionable whether this type of construction would be as warm as that employing wood, lath and plaster, but for most mining districts no trouble should be had from this source.

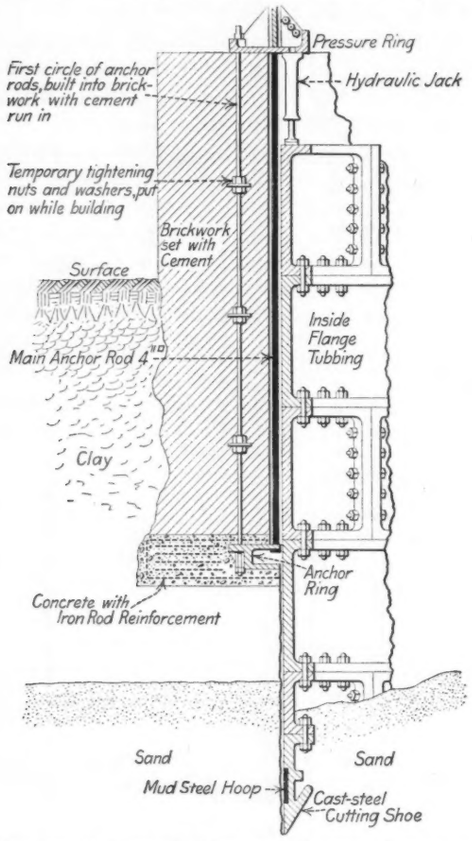
The question of cost is, of course, all-important, but this will vary with the locality to such an extent as to make general figures impossible. It is stated that usually this type will be found cheaper than wood. Specific figures may be of interest. For 10 houses of the design shown in Fig. 1, one of the more elaborate listed, a contractor in Ohio gave a price of $2400. This included a cement-floor basement under half the house, with hollow-tile foundation walls under the entire building; hardwood finish in two rooms and the rest yellow pine; hot-air furnace, complete plumbing, bathroom fixtures, kitchen fixtures and gas piping and appliances; painting, tinting, electric wiring, etc.

The material shipped from the factory for this design is 11,000 lb. of pressed steel and 4500 lb. of Hy-Rib, cost-

ing f.o.b. factory $663, subject to substantial discounts. This included all the frame, such as floorbeams, sill plates, channel studding, lintels, rafters, joint parts and Hy-Rib for inside and outside of walls and for partitions and ceilings.

Drop-Shaft Sinking

A method of drop-shaft sinking as applied by Haniel & Lueg at Düsseldorf, Germany, has been described and illustrated in "The Sinking of Shafts," by R. A. S. Redmayne, chief inspector of mines in Great Britain. This system of shaft-sinking is known in Düsseldorf as the sinking-drum process, and the scheme of operation is almost apparent from the illustration, taken from *Coal Age*, May 1, 1915.



HANIEL & LUEG'S SINKING-DRUM PROCESS OF ADVANCING SHAFT

The sand shown in the lower part of the illustration lies so near the surface that it is necessary to build up the shaft with brickwork set in cement so that there may be sufficient weight against which the hydraulic jacks may be braced in pressing down the cutting shoe into the water-logged sand. The sand is removed by hand or by a clamshell bucket.

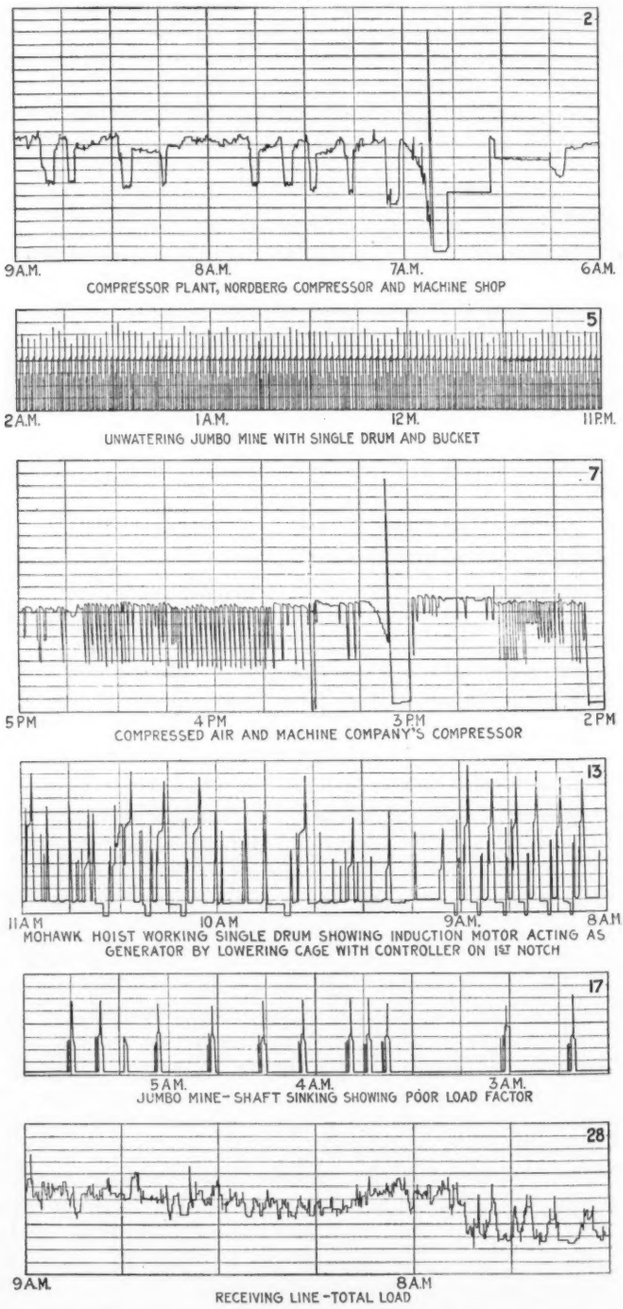
Coke Blacksmiths' Fire

Few blacksmiths use coke in their forges, though it has many advantages over coal and almost no disadvantage after the fire is once ready for use, which does take a little longer than with coal. The coke should be banked up about 1 ft. high and 2 ft. wide, and when the mass is properly coked together, it should be carefully undermined, or scooped out, until it resembles the front of a muffle of an assay furnace. Into this opening six or eight drills can be put, and with the heated arch above them, they will come to proper heat without being buried in fuel. The heat from such a coke fire is more even than can be obtained from a coal fire and intermittent blast. The drills are always in sight and are cleaner, better heated, and more conveniently and expeditiously handled. Once the blacksmith learns this scheme, it is his only method of smithing.

Hoist and Compressor Power Curves

BY P. E. BARBOUR

The poor load factor of mine hoists is emphasized in the reproduction of curves from recording wattmeters



HOIST AND COMPRESSOR POWER CURVES

used at the central station of Goldfield Consolidated. No. 17 shows the Jumbo hoist at work shaft-sinking. Besides the poor load factor shown by the curve, one gets a very good mental picture of the crew in the bottom of the shaft, which sends up one bucket every 15 min. With this record in hand the boss cannot be fooled very much by his night shift.

No. 13 shows the Mohawk hoist operating with cage. The hoist had a single drum driven by an induction motor, and the curve shows the motor acting at times as a generator, when the controller was left on the first notch while the cage was being lowered. This curve indicates plainly the starting torque, the period of acceleration, the drop to zero as the cage is stopped and dropped onto the landing dogs, the sudden demand for enough power to lift the cage from the chairs, and then the return of power to the line during the lowering, if the controller is left on the first notch.

No. 5 shows the Jumbo single-drum hoist unwatering the shaft with a bailing bucket. This curve illustrates the starting torque, acceleration, dropping the bucket on the discharging device, lifting the bucket to clear the discharging device and the lowering. It also shows that the engineer averaging one round trip every two minutes was earning his money.

Nos. 2 and 7 are compressor charts. No. 2 is from a compressor with corliss valve-gear, whereby the intake is throttled to suit the work to the demand. No. 7 is from a compressor of the blow-off type and shows the poor load curve in comparison with the other machine. It also shows the "jerky" load and more severe service on the motor. Both these curves show the starting of the compressor and the period required to bring it up to normal load.

The Consolidated originally had separate contracts for each unit, but by installing a substation of its own and doing its own distributing it raised its power factor to 80% and decreased its power costs from 4c. to 0.9c. per kw.-hr. No. 28 shows the receiving-line curve carrying mines and mills. These economies were effected under L. T. Merwin, electrical engineer for the company.

Carbon-Monoxide Poisoning

A peculiar accident due to gas poisoning in an iron mine was described by Kobrich[1], a translation of which is given in the *Transactions* of the North of England Institute of Mining and Mechanical Engineers for December, 1914. Four men were poisoned in June, 1913, at the Ober Rosbach vor-der Höhe manganese-ore mine in Hesse. At a depth of about 236 ft. a communicating gallery had been driven between the two hoisting shafts of the mine at about 36 ft. above the working level, and the mine had subsequently been drowned out. The gallery was stopped up with mud and débris and had to be cleared. To do this a platform was constructed in one of the shafts at the height of the floor of the gallery, and the latter was cleared to a distance of about 16½ ft. The air in the dead end thus formed was vitiated, however, by fumes from the broken rock and from the wet wood. Fresh air was supplied through a temporary 2⅞-in. pipe by a hand ventilator above, and compressed oxygen in flasks was also supplied to the men below. The ventilation was to be further improved by heating the air, for which purpose the pipe was fixed to a barrel, open at the bottom, in which a stove was installed. The stove was fired with mine wood and shavings, and oxygen was supplied to it from an open flask. The ventilator was worked at intervals during the day, at first bringing up thick smoke. On the following day lights were lowered and continued to burn, and two men descended, but were overpowered by fumes. Two men followed them to see what had happened and met with a similar fate.

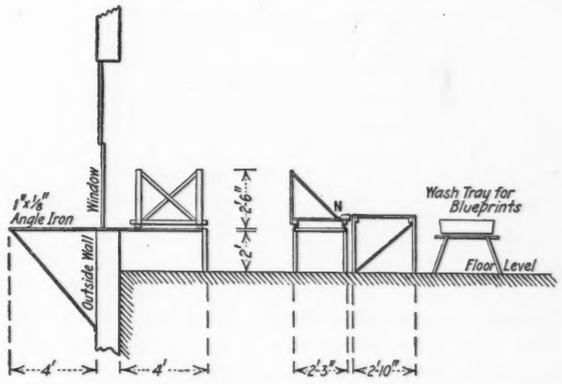
Later investigation showed that the stove had burned fiercely until the oxygen had become exhausted. In the bad air the fire had died down and smoldered at the bottom of the stove. Heavy carbonic acid in the pipe then sank back into the stove while the ventilator was not going, and was there changed into carbon monoxide. The fire had melted the solder attachment of the pipe to the barrel, and when the ventilator was turned again it drew air and black damp from outside, instead of through the stove. The gas thus allowed to accumulate had poisoned the men. A compressor driven by steam gave sufficient ventilation, and the air in the gallery was, on the following day, found to be good and pure.

[1] "Zeit. f. B. H. u. Salinenw.," 1914, Vol. lxii, pp. 171-175.

Carriage for Blueprint Frame

By W. F. Boericke*

The accompanying sketch shows an easily constructed carriage for handling a heavy blueprint frame without assistance. When not in use the frame lies face downward on the wooden stand to the right of the carriage. In operation, the tracing and paper are first inserted, and the frame is then raised perpendicularly and allowed to settle back in the notch *N* of the carriage. Being now free from the stand, the carriage and frame may be run out on the tracks through the opened window. After exposure, the carriage is pulled in, the frame set back on the stand, and the prints transferred to the adjacent wash tray without delay. Angle iron, 1x1x⅛, is used for the track, though channels can be used if preferred. The expense of construction is small, and the labor can be done by any carpenter.



Details of Carriage for Blueprint Frame

A One-Eyed Man Has a Hard Time to convince others he can see as well as he ever did, says the Inland Steel Co.'s "Bulletin." Why not wear goggles for dangerous work?

*Mineral Point Zinc Co., Galena, Ill.

Details of Milling and Smelting

Influence of Impurities on Zinc

In discussing the production of zinc shavings for precipitation in cyanide plants, C. C. Freeman, in the *Monthly Journal* of the Chamber of Mines of West Australia, February, 1915, says that although in many parts of the world zinc dust is to a large extent replacing shavings as a precipitant for precious metals from cyanide solutions, the shavings are still almost universally used in Australia. In small mills the relatively low cost of the installation necessary for precipitation by zinc shavings would outweigh any advantages that would accrue from the use of zinc dust as the precipitant, and in the case of the larger plants which are already equipped with efficient units of the former type, it is a matter of experiment and calculation to determine if the advantages claimed for zinc-dust precipitation warrant an alteration to the latter system.

Most of the English zinc smelters aim at the production of spelter suitable for use in making a good quality of brass, for which purpose little lead is permissible, and such spelter cannot be conveniently rolled. On the other hand, many of the Continental works treat zinc ores and concentrates containing appreciable quantities of lead, and the resulting spelter, after refining, usually contains from 1% to 1½% of lead, which renders the product amenable to rolling.

The rolling qualities of spelter are affected to a marked degree by the impurities present. Moderate amounts of lead render zinc malleable and ductile, and quantities up to 1½% permit good rolling. With more than 1½% of lead, zinc becomes tender; and although when it contains 3% of lead it can be successfully rolled, the sheets are very tender and liable to crack.

Iron reduces the malleability of zinc and makes it harder and more brittle. Up to 0.125% of iron is not injurious, but above this the bad effects become apparent, and passing 0.2% of iron seriously interferes with rolling. Oxygen may occur as zinc oxide, due to imperfections in distilling. If much of this is present the spelter will become brittle and difficult to work. Other impurities may occasionally be present in spelter, and of these cadmium, up to 15%, does not interfere with rolling, while copper, tin and arsenic render zinc hard and brittle.

At ordinary temperatures zinc is quite brittle, and ingots can be easily broken. Between 100° and 150° C. it becomes malleable and ductile, but above the latter temperature it again becomes brittle, and at 200° can be reduced to a powder by pounding. The relatively coarse crystalline structure of cast zinc is destroyed by rolling or hammering, and the specific gravity of the wrought metal is about 7.25, compared with 7.05 when cast. Wrought zinc heated to between 100° and 150° C. retains its malleability and ductility after cooling.

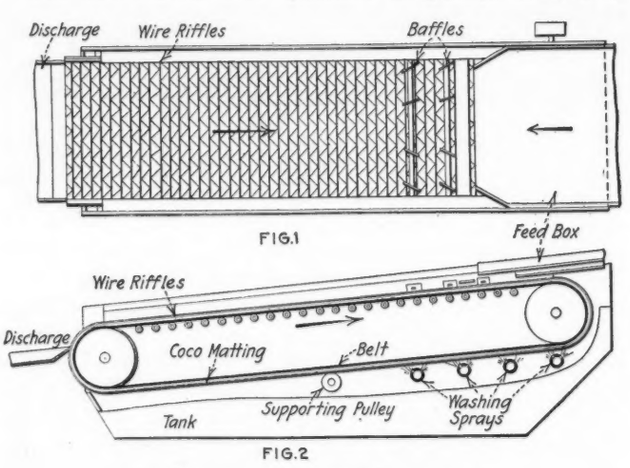
Zinc shavings for precipitation were formerly produced from round disks, which were punched from sheet zinc and clamped together between two iron plates or flanges. This was turned down by a tool moving radially, but the method was responsible for a lot of waste, both from the sheet and from the butts of the disks. The disks cost about £9 per ton above the ruling market price of spelter. The shavings are now almost universally produced from sheets of zinc wrapped about a wooden mandrel, forming a cylinder about 3 ft. long and about 6 in. in diameter. This is cut with a tool with a lateral travel, and no zinc is wasted. The average price of sheet zinc, f.o.b. Antwerp, during 1913 was £3 14s. 6d. above that for spelter.

By the use of a special turning tool it has been proved that it is possible to produce a shaving direct from cast spelter; but the process is so slow that the cost of such turning is greater than that of shavings produced in the ordinary way. The shavings produced by this method are more brittle than those from the sheet metal, and would probably yield an excessive quantity of short zinc when used in the precipitation boxes. A zinc ribbon has recently been placed on the market as a substitute for ordinary zinc shavings. This is produced by fine streams of molten zinc falling on a rotating water-cooled drum, which has a peripheral speed of about 950 ft. per minute. The ribbon, although of about the same thickness, is much wider and more ductile than the ordinary shaving, and after being in contact with cyanide solution for a time it would probably have a tendency to pack in the boxes.

Newsom Placer Machine

The Newsom placer-mining machine, invented by John F. Newsom, of Palo Alto, Calif. (U. S. pat. 1,127,667), is in effect a traveling-belt concentrating machine, operating a good deal on the principle of the vanner.

The belt travels over cylinders or pulleys located at



NEWSOM PLACER MACHINE

each end and is inclined at the proper angle to accomplish the desired results. On this belt there is a cocomatting cover which serves as a concentrating medium, entangling and holding the fine particles of gold and mineral. Over the whole there is a coarse mesh of wire which serves as riffles, while cross-bars with short baffles

are placed at intervals to direct the pulp current onto the belt, instead of off at the edges. On the under, or return, side of the belt, there are a supporting pulley and, in addition, several cleansing jets. Just under the feed launder, clear water is admitted to give a final wash to the concentrates formed on the belt. The accompanying illustration shows the construction of the machine—the feed, traveling belt, tailings discharge and concentrates washers.

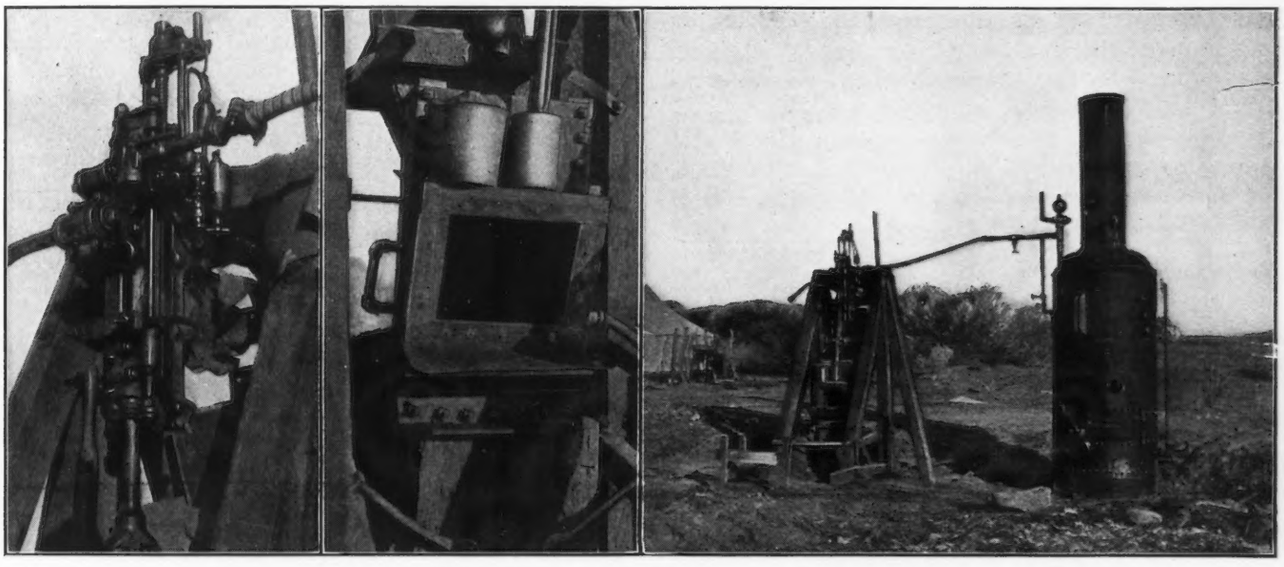
Flotation at Timber Butte Mill

Owing to the paucity of data on flotation operations, the information contributed[1] by Theodore Simons on the work of this department at the Timber Butte concentrator is of interest. This mill treats the ore of the Elm Orlu mine at Butte. The ore is complex, containing gold and silver free and combined with sulphides of lead, zinc, copper and other metals; the gangue is chefly quartz, fluorite, rhodonite and rhodocrosite. The ore is first treated by table concentration, the tailings being reground in Hardinge mills to pass 60 mesh. The pulp going to the flotation department is thickened to a density of three parts of water to one of ore and is heated to 130° F. by the introduction of live steam. Sulphuric acid is mixed with the pulp in the ratio of 7 to 8 lb. of acid to every ton of original ore going through the mill. Oil is added in the proportion of 0.5 lb. to the ton.

The pulp for flotation goes to a standard 600-ton 11-cell Minerals Separation rougher unit which produces concentrates, middlings and clean tailings. These concentrates contain about 47.8% Zn and 14% of insoluble and are cleaned in a 200-ton 8-cell Minerals Separation finisher unit, being fed into the first and fifth cells. Concentrates, containing 52% Zn, 3.5% of insoluble and some lead, copper and iron sulphides, are taken from cells Nos. 1, 2, 3, 5, 6 and 7 of the finishing machine and passed to an Esperanza and then to a Richards hindered-settling classifier; the fine concentrates from both classifiers go to the concentrate house for dewatering, but the coarse concentrates are re-treated on James No. 3 tables to remove the lead, copper and iron sulphides. The middlings from Cells 7, 8, 9, 10 and 11 of the rougher unit are returned to the roughing flotation machine after classification and regrinding in Hardinge mills. The bottom discharge from Cells 4 and 8, of the finisher unit, are classified and reground with the middlings of the rougher unit, but the middlings overflowing from Cells 4 and 8 of the finisher unit are re-treated in the same machine, being returned by an air lift. The clean tailings from the rougher unit before going to waste are passed through a 36-ft. Dorr thickener for the extraction of hot water which is re-used in the flotation operation.

The agitation compartments of the flotation cells are lined with cast iron and the propellers are made of brass. All agitators of the standard machines are driven from one main shaft by gears protected by steel housings; the gears are so placed that propellers in adjoining cells revolve in opposite directions, thus equalizing strains on the machine and the power transmission. The propeller shaft makes 265 r.p.m., causing the propellers to have a peripheral speed of 1500 ft. per min. The pulp is violently churned and passes to the flotation compartment, where the sulphide-bearing froth is removed; the unfloated gangue and middlings drop to the pointed bottom of the flotation compartment. A pipe connection and valve feed the unfloated material to the next agitating cell, the flow being assisted by the pumping action of the impeller. At this mill the oil is introduced in the agitating compartment of the first cell.

[1]"Bull. of A. I. M. E.," June, 1915.



A Compressed-Air Drill Serving as a Stamp Mill

An Improvised Stamp Mill

An improvised stamp mill which has succeeded in getting the necessary results is shown in the accompanying photographs. It consists of an old reciprocating drill of standard type mounted in a wooden frame and working in a built-up mortar box made of iron sheets and angles. The shoe (which is shown in one of the illustrations) is a cast-iron cylinder. Steam is provided by an old boiler of the vertical type.

The capacity of the mill is 0.8 ton per day, the ore being the intermittent production of some high-grade gold stringers. The installation is at Surprise Springs, San Bernardino County, Calif.

Company Reports

North Star

The report of the North Star Mines Co., Grass Valley, Calif., shows a profit of $553,603 for 1914, of which $103,603 was added to quick assets and $450,000 paid out in dividends. The North Star mine produced 113,242 tons, which yielded 107,250 tons of sorted ore for the mill. The average grade of the ore before sorting was $9.851, and the sorted ore averaged $10.402 per ton. The production of the North Star amounted to $1,115,587; the Champion Mines produced $301,103, and dividend and interest receipts amounted to $39,547. The total receipts were $1,456,237. Operating and development expenses at the North Star were $582,338. Improvements totaled $10,528 and property purchases, $2153. Champion mine expenses and increase in supplies amounted to $307,615. The total expenditures were $902,634. The following table gives details of operating costs, not including improvements, at the North Star:

Operating expenses:	Per Ton of Ore Mined	Per Ton of Ore Crushed
Mining	$2.882	$3.043
Milling	.588	.621
Cyaniding	.393	.415
Bullion	.028	.030
Miscellaneous	.283	.299
New York office	.180	.190
Taxes	.237	.093
Accident and benefit	.088	.093
Total	$4.679	$4.941
Less sundry receipts	.018	.019
Total operating expense	$4.661	$4.922
Development (2053 ft.)	.481	.508
Total operating and development	$5.142	$5.430

Of the total production, 79.04% was recovered in the mills by amalgamation and 20.96% was recovered by cyanidation. The tailings from the cyanide plant assayed 30.5c. per ton, or a little less than 3% of the value of the metal contents of the ore.

Isle Royale

The Isle Royale Copper Co., Houghton, Mich., reports for 1914 a profit of $24,374 from 6,601,235 lb. of copper sold at 13.16c. per lb., and silver sales of $17,477. At the end of the year the company had $199,815 of assets on hand exclusive of mine and plant.

The following tabulation will give the operating record of the Isle Royale for the last four years:

	1911	1912	1913	1914
Tons of rock treated	457,440	531,105	314,679	474,349
Yield, pounds of refined copper per ton	16.4	15.4	13.2	13.9
Cost per pound of copper (in cents):				
Mining, milling and transportation	8.97	10.01	16.07	10.67
Construction	.25	.20	.73	.53
No. 7 shaft	.00	.15	.27	.00
Shaft "A" and explorations	.07	.05	.01	.00
Unwatering Huron mine	.06	.08	.10	.05
Smelting, freights, commissions, office, etc.	1.21	1.31	1 53	1.46
Interest	.29	.09	.10	.21
Total cost per pound	10.85	11.89	18.81	13.05
Development work included in above costs:				
Shafts, feet	897	941	502	225
Openings, etc., feet	15,366	19,106	13,626	9,694
Percentage of hoisted rock discarded	18.7	14.7	15.4	12.4

The stamp mill was destroyed by fire on Dec. 24; the total loss was between $130,000 and $150,000, of which $100,000 was covered by insurance. The company hopes to have the new mill in operation during the present month. The railroad transported 191,597 tons of rock for the Superior mine for 7c. per ton, thereby reducing the cost of handling the Isle Royale rock to 3.83c. per ton. Work on full time was resumed on Feb. 1, 1915, after operating on three-quarter time on account of the war.

Federal Mining & Smelting

An analysis of the figures given in the report of the Federal Mining & Smelting Co., Wallace, Idaho, for 1914 shows that there was a balance of $384,268 available for dividends from 1914 operations after deducting all expenditures. Of this amount $117,342 came from a decrease in the investment account. The following table will show the financial statement in detail as worked out by this analysis:

Balance of quick assets at end of 1913		$1,149,061
Balance of quick assets at end of 1914		934,024
Decrease in quick assets during 1914		$215,037
Total receipts during 1914:		
Value of product	$2,200,778	
Rentals	18,852	
Interest	21,258	
Miscellaneous	2,353	
Dividends from investments	84,000	
Dividends from Green Hill-Cleveland Mining Co.	576,000	
From decrease in investments	117,342	
Total receipts		$3,020,583
Total expenditures in 1914:		
For mines and equipment	$285,470	
Cost of production	1,144,866	
Smelter, freight and treatment	866,818	
General expenses	94,663	
Depreciation*	136,861	
Star option and development	39,915	
Flynn group option and development	10,500	
Litigation expense, Norman suit	15,251	
Frisco plant operations	41,970	
Total expenditure		2,636,315
Balance of receipts over expenditures		$384,268
Source of dividends:		
From balance available from 1914		$384,268
From quick assets		215,037
Dividends paid on preferred stock		$599,305

*Apparently a current expenditure.

There were mined in all the properties 421,631 wet tons of ore, of which 21,091 tons were first class. The mills treated 389,450 dry tons of ore. There were produced 57,058 tons of lead concentrates and shipping ore averaging 44.67% lead and 16.01 oz. silver per ton and 4200 tons of zinc shipping ore and concentrates averaging 44.61% zinc. The first-class ore shipped from Wardner averaged 51.2% and from Morning 29.6% lead. The average price for silver was 54.8c. per oz. and $3.869 per cwt. for lead. All development work during the year amounted to 7256 ft. At the Green Hill-Cleveland mill a flotation unit of 65 tons' capacity was installed. The Frisco mill is also being equipped with a flotation unit with a capacity of 350 tons a day. Ding magnetic separators are also installed.

Ore reserves are estimated to contain 988,450 tons of mill ore and 48,640 tons of first-class ore. The average number of men employed at all plants, exclusive of the Wallace office, was 997, at an average wage of $3.675 per shift, as follows: Wardner, 288 men; Morning, 345; Frisco, 55; Star, 11; total Federal proper, 699; Green Hill-Cleveland, 298; total all plants, 997 men. A total of 28 properties was examined by the engineering staff, but none was taken up. The total cost of these examinations amounted to $4835. The decrease in earnings during 1914 was principally due to the suspension of work at the Morning for about five months and other curtailments on account of the war.

Ahmeek Mining Co.

The Ahmeek Mining Co., Houghton, Mich., reports for 1914 a profit of $462,643 from a production of 13,643,605 lb. of copper which sold at 13.08c. a lb., and silver sales of $4025. Dividends amounting to $200,356 were paid, making a total of $2,400,000 paid to date. After payment of dividends there remained a balance of $262,643, which was added to the assets. The total assets at the end of 1914 were $968,771.

The following table will give the operating record of the Ahmeek for the last four years:

	1911	1912	1913	1914
Tons of rock treated	598,549	652,260	383,749	590,519
Yield, pound of refined copper per ton	25.4	25.2	24.0	23.1
Cost per pound of refined copper (in cents):				
Mining, milling and transportation	5.61	5.51	7.38	6.73
Construction	.32	1.20	4.53	1.68
Smelting, freights, commissions, etc.	1.19	1.14	1.39	1.30
Interest	.05	...	...	...
Total cost per pound	7.17	7.85	13.30	9.71
Development work included in above cost:				
Shafts, feet	1,284	1,336	104	....
Openings, etc.	11,691	9,828	5,285	4,587
Percentage of hoisted rock discarded	1.9	2.2	0.4	0.03

Plans are being made to resume the work on additions and equipment at the stamp mill, which was suspended in August. Full time was resumed on Feb. 1, 1915, after operating on three-quarter time on account of the war.

Mason & Barry, Ltd.

The English company of Mason & Barry, Ltd., owns and operates the deposits of copper-bearing pyrites at Sao Domingo, Portugal; it also owns the stock of La Sabina Co. in that country. The report for the year ended Dec. 31, 1914; shows that the capital stock at that date was £185,172 in shares of £1 each.

The total quantity of ore mined in 1914 was 259,238 tons, against 378,929 tons in 1913, a decrease of 119,691 tons, or 31.6%. Shipments, including ore from the cementation works, were 257,616 tons, against 363,208 tons in 1913. The decrease was due to the cessation of shipments to Germany.

The income account shows net earnings from mine operation, £29,008; La Sabina dividends, £7557; interest, etc., £3861; total, £40,426. Managing expenses in England were £7499; depreciation in investments, £1589; total, £9088, leaving a surplus of £31,338. From this the board has appropriated £27,776 for dividends of 15% and £1000 for the staff pension fund, leaving a surplus of £2562. The dividends paid in 1913 were 35%. Adding the balance of £15,550 brought forward from 1913 leaves £18,112, brought forward to current year.

The stocks of ore and copper precipitate on hand in England and Portugal were valued at £64,061, a decrease of £20,523 from the previous year.

Dividends have been paid in each year from 1892, varying from 10 to 65%; the total paid in the 23 years having been £7 2s., or 710% per share.

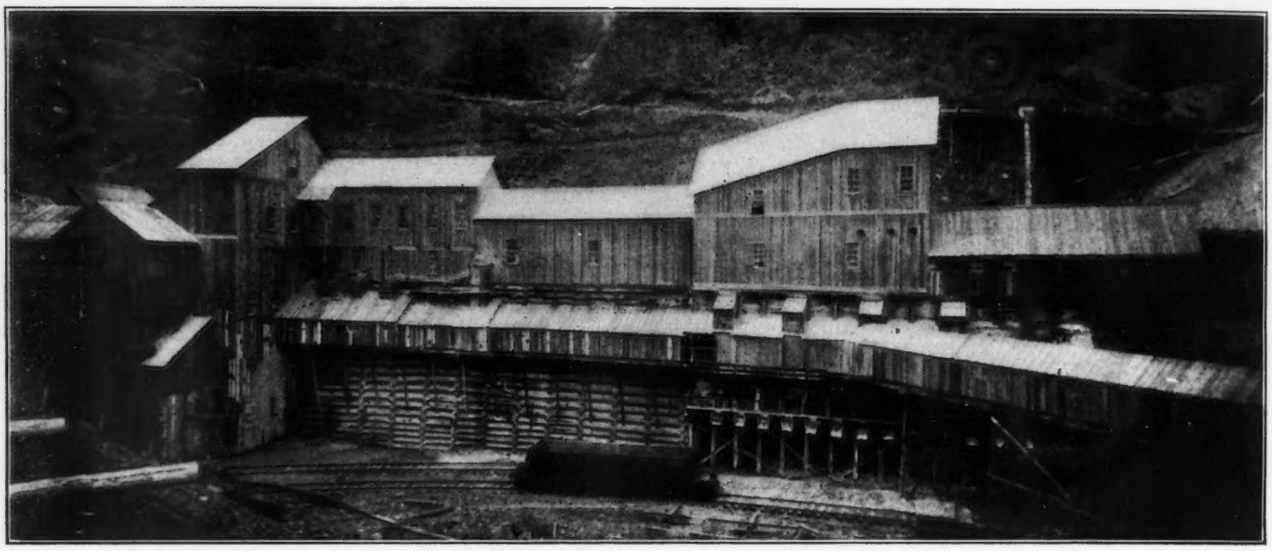
Utah Consolidated

The Utah Consolidated Mining Co., Bingham Cañon, Utah, reports for 1914 that 153,345 tons of copper ore and 48,492 tons of lead ore were mined. The production from this ore consisted of 7,584,391 lb. of copper, 14,588,276 lb. of lead, 284,196 oz. of silver and 15,528 oz. of gold. Profits reported for the year were $565,665 and dividend payments aggregated $600,000. The average assay of the copper ore was 2.509% Cu, 0.085 oz. Au, 0.966 oz. Ag. The lead ore averaged 16.713% Pb, 0.053 oz. Au, 3.275 oz. Ag, and 0.755% Cu. The 1913 report refers to a 1500-ft. crosscut that was being driven into the upper limestone. This work was completed, and in addition 3500 ft. of drifting and raising was done and an incline shaft sunk at present to 689 ft. The ore in this area occurs in irregular-sized shoots, with an average width of 4 ft. and an average assay of 16% Pb, 2.06 oz. Ag and 0.043 oz. Au. There are indications that the orebodies in this ground will be maintained as to size and grade. The ore reserves are estimated to contain 256,521 tons of ore averaging 1.9% copper, 0.054 oz. gold, 0.697 oz. silver and 50,365 tons of ore averaging 16.48% lead, 0.048 oz. gold, 2.68 oz. silver and 0.6% copper. The profit, as stated, does not take into account an expenditure of $24,275 for mine plant written off profit and loss account.

Hedley Gold Mining Co.

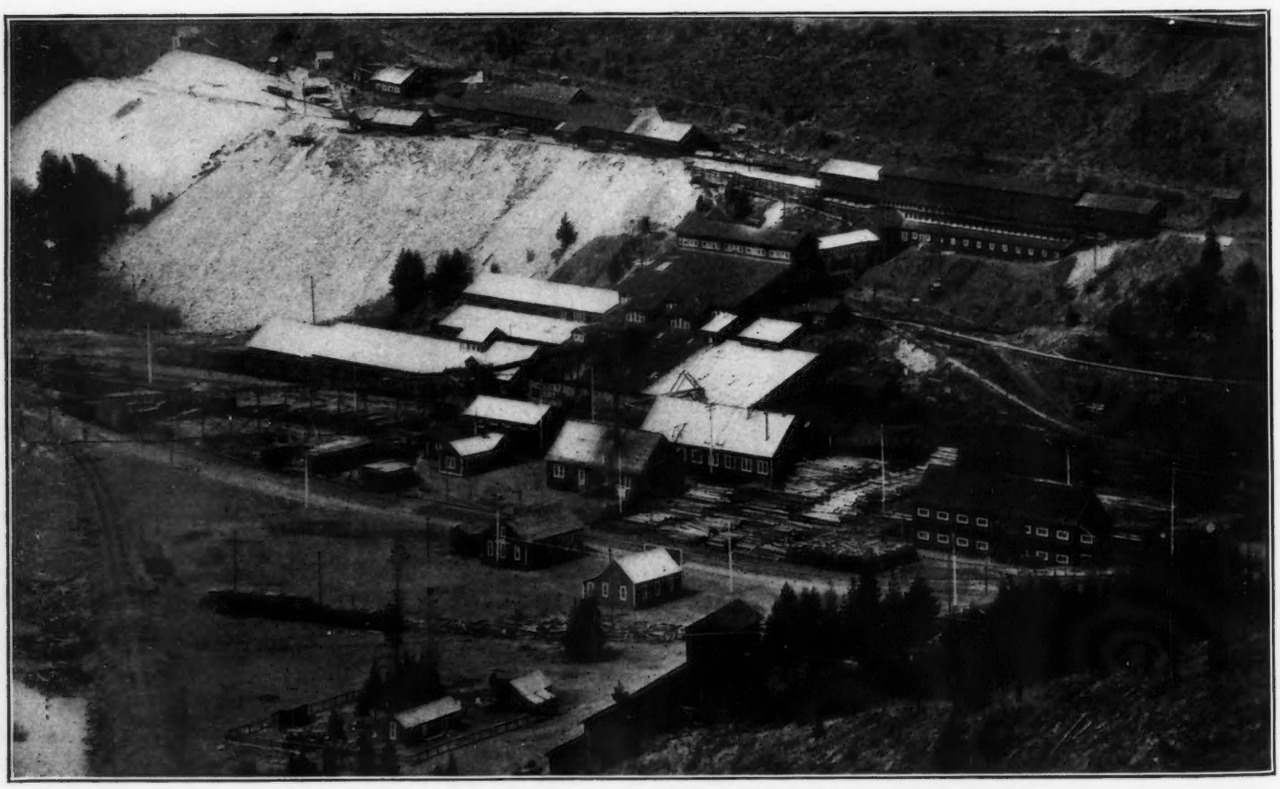
The Hedley Gold Mining Co., Hedley, B. C., for 1914 reports a production of 78,494 tons of ore yielding $797,340. Expenditures, after crediting $6274 in interest receipts on funds of the company, amounted to $409,112. Profits were $388,228 and dividends aggregated $300,000, which is 25% upon the issued capital stock. An 1800-hp. hydro-electric power plant was completed at a cost of $192,009, or $7991 below the original estimate of cost. Since the company was formed $474,275 has been expended and charged to capital account. Of this amount $136,353 was for additions to the mill, $145,913 for new claims purchased and $192,009 for the new power plant. The mill heads averaged $10.80 by assay, or a total of $847,349. Of this $644,851 was extracted by concentration and $152,489 by cyanidation. The total mill extraction was 94.09%. At the end of 1913 it was estimated that the mine contained 413,000 tons of $10 ore in reserve. In this report it is stated that diamond-drilling, drifting, and stoping indicate that there is now as much ore in reserve as there was at the end of last year. The company ended the year with a surplus of cash and bills receivable amounting to $166,049. There were no current liabilities reported.

Photographs from the Field



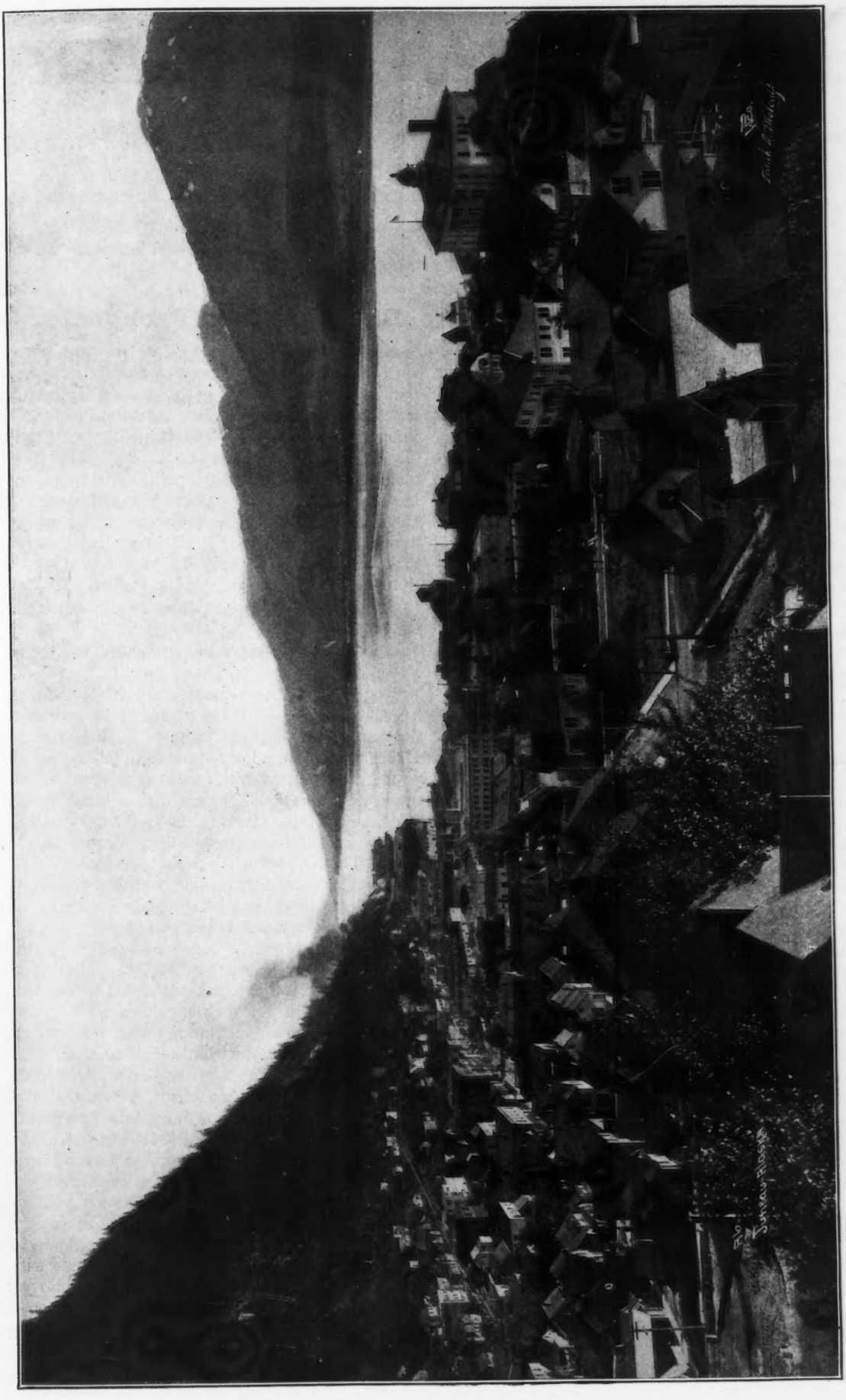
ORE BINS AND SORTING PLANT OF THE LAST CHANCE MINE, WARDNER, IDAHO

Property of the Federal Mining & Smelting Co. In 1914 there was an average of 288 men employed here. The first-class shipping ore carried 51.2% lead



SURFACE PLANT OF MORNING MINE, MULLAN, IDAHO

Property of the Federal Mining & Smelting Co. A flotation plant was installed at the Morning mill in 1914, of 480 tons daily capacity. The equipment includes, besides 18 flotationcells, a 50-ft. Dorr thickener and two 250-sq.ft. Kelly filter presses.



A View of Juneau, Alaska, and Its Harbor

Correspondence and Discussion

Employment for Idle Engineers

The suggestions under "Employment for Idle Engineers" in the May 1 issue of the valued and indispensable JOURNAL are a real inspiration in these hard times, especially to the species without resources.

After the most skeptical and scrutinizing dissection of your so hopeful evangelism, which even does not exclude a "Freiberg aristocrat" from a possible grubstake, I am able without dignity's fear (having "done" only assaying, mill work and surveying) to muster enough courage (youth's fire and enthusiasm having not quite subsided) to accept the cherished assumption that some adventurous capitalist may invest some of his spare coin in a grubstake and gamble it against the chances of *not* finding a mine.

It is unquestionable, there are immense areas out West which have only been prospected by the ways of '49 and which may yield big rewards to the modern prospector. There is, for example, a big section east of Sumpter practically virgin, though with the finest probabilities, of which the surface compares most favorably in geological and mineralogical appearance to some of our biggest mineral districts, the main features being big deposits of limonite and hematite 50 to 100 ft. wide between limestone and argillaceous shales (porphyritic). This iron hat can be traced for approximately 2½ miles. Erosion was not active and the gossan is much leached and porous and seems to extend to considerable depth. No commercial minerals are discernible on the surface, but a gold assay from a trace to a few dollars may be obtained occasionally. Wad, hydrated manganous manganate, with slight impurities, gives an appreciable Co reaction. In my opinion these indications ought to justify a moderate expenditure for drilling tests, which most likely would prove considerable orebodies in depth.

Then about 26 miles west of Sumpter is an area of biotite gneiss intruded by granite (pegmatite), andesite and rhyolite dikes. The work performed in the early days by old timers can be much improved on. This district is practically abandoned. Float that I assayed from this section gave very high return in gold and silver, tellurides being present.

In addition some data on about 1000 acres of ideal possible dredging ground well worth prospecting ought to loosen the heart and purse strings of some Crœsus with gambling propensities.

C. A. BRAUNGER.

Sumpter, Ore., May 5, 1915.

Timbering Stopes for Safety

In "Timbering Stopes for Safety," by H. H. Hodgkinson, in the JOURNAL of May 8, is this sentence: "Considerable time and labor will be saved in cutting the miter of two timbers by bisecting the angle formed by them and cutting each timber at a bevel of that angle."

How are this angle and the consequent proper miter bevel determined? Is the timber used in these stopes recovered; and if so, how is this accomplished in the case of a truss set high above the floor?

SOURDOUGH.

Goldfield, May 13, 1915.

Bill McGinty, Prospector--III

Misther Editor—Well, we lost so much time foolin' with the felly that had the spicimins av titanium iron ore that the *mozos* an' carga got pretty well ahead av us; but we caught up in time to camp that night close to the Continental Divide again. The third day we got to where 'tis all on the Pacific Slope. There ye have fine timber, plenty av deer, wild turkey, quail, hot springs an' fuchure health resorts, fine ripplin' an' plungin' streams av clear an' glad-soundin' water, ivery wance in a while full av hungry trout; an', take it all in all, most iverything to make life wan sweet song excipt the kind av thing the Stars an' Stripes was invinted to protict. The fellies that live there are Mexicans, but they're different from the fellies around the towns an' the patrishuns' peonized *haciendas*. Some av thim are like William Tell, an' as skilful at shootin'.

The third night we camped in a delightful pine forest, a little ways beyond the Guitarra ranch, leavin' the trail far enough to pick out a suitable boodwar near a spring. Durin' the night a light snow fell, an' the air was what ye might call invig'ratin'. In the mornin' we solved the myst'ry av some queer groanin' noises which had disturbed our beauty sleep. Close to the trail was what had wance been a fine Holstein cow, belongin' to some Michigan folks. The NaCN for the mill av the Bacis Gold & Silver Mining Co. was either carelessly packed for shipment via the mule train or had been meddled with by some suspicious Custom House official. The poor cow, not havin' the advantage av even a corryspondinse coorse, mistook it for NaCl—earnin' a mark av 75% in spellin', a failure in chemistry, an' 100 per cint. extraction av the vital spark.

On the fourth day we went down a little, up a little, down some more an' on through park after park; crossin' trout streams, an' me wishin' for a leader an' flies; killin' a squirrel with a rifle-shot from the saddle an' then havin' the cinch-strap bust when pickin' him up with the right low reach I learned when a young felly in a cavalry troop. Annyhow, I got the squirrel first; but 'tis a good thing to raymimber that a mule is built different from a horse, an' if ye try stunts ye must expict trouble. Pick out flat places for fancy work, an' if ye have much uphill an' downhill travelin' use a single cinch an' a breast strap an' crupper—on the mule, I mane. Get off an' walk wance in a while when the goin' is steep, an' the mule will eat out av yer hand. If ye don't she may try to bite yer leg or step into the saddle an' change places with ye. A nice, well-bred lady mule will gin'r'lly act like a lady if ye treat her like wan; but a *macho* is more like a dimmycrat after four raypublican administrayshuns.

Now an' then from an open part av the trail ye can get a glimse av the valley av the Bacis River. Most av the country over which we had passed in the first part av the trip seemed to be pretty well covered over with sidimintary an' lava-flow volcanic rocks. I can hear the tungsten felly offerin' an objection to the word *sidimintary*. Wance durin' the ensuin' summer I was havin' a picnic av a trip down toward Ventanas, tryin' to find the old Indian route from Huehuento Mountain to Tayoltita, in company with a real ingineer crony named Adam C. Walters, or somethin' like that. We rollicked along, sizin' up the geology in a superfish'l way like Jim Furman. Somewhere near the top av the world we rode under a kind av overhangin' cave. The rock was a curious kind av a big nachr'l puddin', with big boulders for plums, little boulders for currants, an' ashy sandy stuff for flour an' sugar. "'Tis cooked," sez Adam. "Help yersilf," sez I; "I'm not hungry." "It luks like a sidimintary," sez he; "an' I wud call it a conglom'rate on suspishun." "'Tis volcanic," sez I. "By their ash ye shall know thim."

"'Twas dayposited," sez he, "an' I can prove it." Jist then came a clap av thunder follyed by a flash av lightin', simultaneously speakin', an' hailstones began to pelt us. "Ride for yer life," sez I as loud as I cud. "'Tis bein' dayposited on us this minute." Whin we was safely camped in a *jacal* at the cul-de-sac ind av the wrong trail, we filled up on *frijoles* an' *tortillas* an' thin got ready to raysoom the argymint.

"Mac," says Adam, "we're both right. 'Tis sidimintary, 'tis volcanic, 'twas dayposited, 'tis ash, 'tis puddin', 'tis conglom'rate, 'twas made in a river, 'twas made in a lake, 'twas made on the top av the mountain. That stuff was dayposited like the hailstones, from the sky. It fell on the lakes an' rivers av lava on the mountains. That piece av a cave was made by some that fell on the edge av a puddle av lava, an' a million years later the lava slid out from under. The geology is satisfact'ry."

We niver got back to that same spot again, so we have not as yet altered our opinions. Wud it not be interestin' to have some av the cellybrated geologists go back to the scenes av the inspirashun av some av their long an' l'arned discoorses, after some av the ign'rant an' un-eddicated impractical miners have gotten rich minin' out some av the ore that was theoretically non-existent?

Brooklyn, N. Y., May 15, 1915. BILL MCGINTY.

(*Cheer up, the end is in sight!*)

Murders in Mexico

In the JOURNAL of May 8 the Douglas, Ariz., correspondent, writing of conditions in northern Sonora, says: "During all this trouble Americans and foreigners have been well treated by both parties, and the two Americans who were killed near Nacozari by Mexican miners have been avenged by the authorities, who captured the two men and had them shot next day." The two men who were murdered (Dunn and Francis) were British subjects. At first they were thought to be Americans and nothing was done toward having the murderers arrested, but the British vice-consul at Douglas took the matter up, with the result stated by your correspondent. I have not heard of any well-authenticated case of any Mexican being executed for murdering Americans since the revolution started.

Miami, Ariz., May 15, 1915. W. MOTHERWELL.

Mexican Mining Law

In the JOURNAL of Apr. 10, 1915, there appears an editorial under the caption, "A New Mining Law in Mexico?" While the essence of your message to the men who are interested in mining in Mexico will undoubtedly meet the approval of a majority, there is one minor point which should be made a little more clear. I do not desire to precipitate a controversy, as Mexico is already over-supplied with that sort of thing, but almost every writer of Mexican mining news (I do not exclude myself from this category) falls into the error of considering that the mines are indeed owned by individuals and corporations. The Mexican mining law of 1910, sometimes characterized as the "Calero Law," states in the first article of the first chapter that certain deposits of inorganic substances are the property of the direct dominion of the nation. Article 2 of the same chapter specifies what class of deposits are the exclusive property of the owner of the soil.

Dating from the conquest of Mexico by Spain, all mines such as gold, silver, etc., have been the property of the government. Leases of such mines to miners and mining companies have, in many cases, continued in force for so many years that the operators have acquired the habit of considering themselves the actual owners of the mines. Further, under the *avie* system, the lessees from the government conceded what were practically subleases to "habilitators." These habilitators, in turn, after many years of uninterrupted enjoyment of the profits derived from their operations, acquired the rocking-chair habit of complacently considering themselves the owners of the mining properties. To drop into the vernacular, it might be said that as long as they could put this stuff over they got away with the goods, but sometimes a day of reckoning comes. In criticizing apparently hasty and unjust new mining edicts, it would be well to study carefully the history of each mining property concerning which complaints may be made. A well-known mining engineer, author and editor, in a book of travels which included a journey through Guanajuato and other Mexican camps, made specific reference to the slim chances which the owners of the old *aviado* rights in certain Guanajuato properties stood of ever getting another accounting on the old contracts. This because of the clever system of bookkeeping, which showed the operating expenses to be so high that there was a monotonous repetition of "nothing doing" on the credit balance. The author in question wrote as if approving of the practice, or at least leaning somewhat toward a *laissez faire* policy.

While Villa's edicts may be hasty and open to the criticism that they savor of an illegal alteration of contract conditions during the term of a lease, or of a "horse bucking off his rider while crossing a stream" (this is cribbed from the maxim about changing horses, etc.), it may, nevertheless, be urged that the celebrated Alexander broke a few old-fashioned rules when he cut the Gordian knot instead of attempting to untie it.

Coming back to the original quibble, how can a *de facto* government confiscate foreign-owned property when the property really belongs to a *de jure* government which does not exist, but is temporarily represented by separate *de facto* governments in different localities?

WILLIAM B. MCKINLAY.

New York, May 18, 1915.

Dinner to Professor Munroe

A testimonial dinner to Henry Smith Munroe, professor of mining in Columbia University, 1877-1915, was given by his old students in the Schools of Mines, Engineering and Chemistry at the Chemists' Club, New York, on May 28. The special occasion for this was the approaching retirement of Professor Munroe, which is to occur coincidently with the close of the present collegiate year. Professor Munroe, who is the senior member of the faculty, will then have completed 38 years of service.

The dinner was arranged by a committee of which George C. Stone, '79, was the chairman. Over 100 attended. The speaking following the dinner was begun by R. V. Norris, president of the Alumni Association, who introduced Prof. J. F. Kemp as toastmaster. The other speakers were Nicholas Murray Butler for the university; Thomas Haight Leggett for the American Institute of Mining Engineers; Walter Renton Ingalls for the Mining and Metallurgical Society of America; and John Parke Channing for the Alumni. In concluding his remarks, Mr. Channing gracefully presented to Professor Munroe, on behalf of the former students of the latter, a massive bronze—the Sluice-Miner—by Louis Potter.

Professor Munroe in acknowledgment of the testimonial to him delivered the address that is printed herewith. This was received with warm appreciation by those at the meeting, who considered that it revealed Professor Munroe to a depth that had not previously been perceived even by his oldest and most intimate students. President Butler had previously aroused great enthusiasm by the expression of his own views of the high quality of the man and by his pronouncement that the old School of Mines, in which Professor Munroe was always important, was without any doubt the real foundation of the new and great Columbia. The meeting was one of which both Professor Munroe and Columbia men generally have reason to be proud.

Professor Munroe's Address

A wise man once said, "An ounce of taffy is worth a pound of epitaffy." I suppose that I shall have to do without the epitaffy. I feel a little as if I were attending my own funeral feast. A year ago I came very near to being the subject for a funeral discourse, but thanks to Heaven and to the doctors, I am very much alive tonight and able to hear and enjoy the very flattering things that have been said about my work.

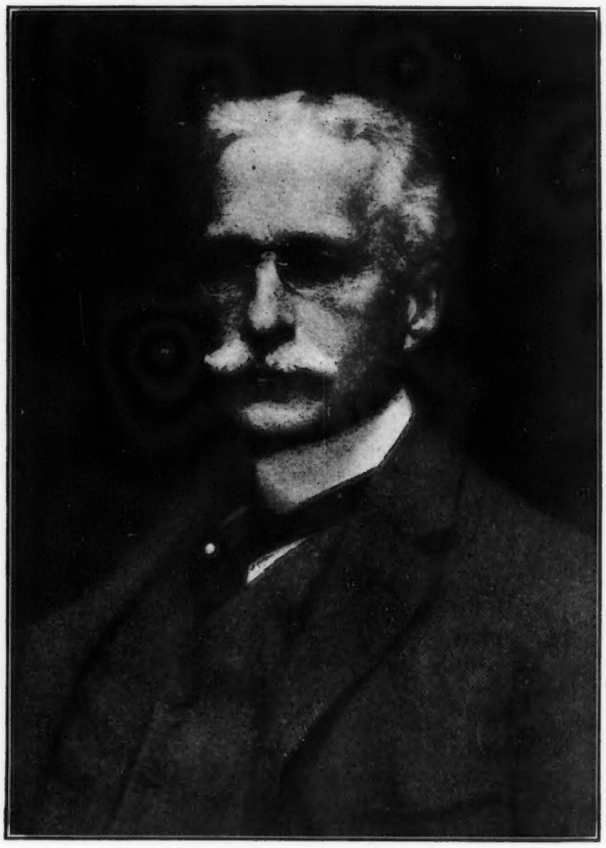
Not Easy to Reply to Eulogies

It is not easy for a modest man to stand as much eulogy, as many obituaries, as I have heard tonight, and it is not easy for a diffident man to reply to such praise or to acknowledge it as it deserves, especially if one is embarrased by the knowledge that the picture is overdrawn, that one has not really earned quite so much credit. It would be strange indeed, and I should be much ashamed of myself, if in 38 years I had done nothing out of the ordinary. I am proud of my modest contributions to the reputation and influence of the School of Mines of this great university. I have enjoyed the working out of new ideas in the education of mining engineers. It has been a great pleasure to contribute to the usefulness of the School of Mines and to the efficiency of its graduates.

I am, however, quite conscious that I have left undone some things that I ought to have done; and have done, sometimes, what I ought not to have done. Perhaps I may be able to do some of these things left undone in the future. But one often makes good resolutions. It is not easy to be altogether cheerful when the time comes that one must surrender that which makes life most worth living, to give up one's chief interest in life, whether that be the struggle for wealth, the pursuit of happiness, or just plain everyday work. It is not easy to say—"It is done." And when one's work is also one's pleasure, when one's occupation is as interesting and absorbing as mine has been, the thought of giving it up is not made any easier.

Credit for the Development of the School of Mines

The credit for developing a scheme of instruction in such an institution as the School of Mines must be divided. No one man can claim or should be given



Prof. Henry S. Munroe

credit for more than a small share in the final result. We must not for a moment forget what we owe to the founders of the School of Mines, Egleston, Chandler, Newberry, Vinton and Barnard. The idea was Egleston's. His was the vision of what might be done for the country by a well-equipped school in which the sciences of mining and metallurgy should be well taught. Chandler was from the beginning the organizer and administrator. He made the idea practicable and the teaching practical and effective. Vinton was an erratic genius, a fine mathematician, an able engineer, a skilled draftsman, and he laid the foundations which made the School of Mines an engineering rather than a scientific school. At first the instruction in geology

was assigned to Professor Chandler, but later the new School of Mines was fortunate in securing John S. Newberry, whose reputation as a geologist, whose experience as an administrator and whose lovable nature added much to the strength and character of the teaching force. President Barnard, scholar, mathematician, physicist and eminent educator, gave to the new school encouragement, sympathy, wise guidance and enthusiastic support.

We must not overlook the services of others, who from the beginning have contributed financial support, wise counsel, helpful guidance and personal service. President Low, President Butler, the trustees of the university, later members of the faculty, Ricketts, Hutton, Kemp, Peele, Walker, and many others, the alumni of the college and of the School of Mines, and the many benefactors, including the donor of the School of Mines building, Mr. Adolph Lewisohn.

As we all know, the new school was a success from the beginning. Planned for a few students, it had to increase its teaching force immediately. To meet the unexpected emergency, a number of the Columbia professors volunteered their services and were at once enlisted in the work. Van Amringe, Peck, Rood and Joy took the subjects of mathematics, mechanics, physics and general chemistry.

School of Mines Founded on Practical Instruction

The original idea was to make the School of Mines a graduate school, but it was soon found that a preparatory year was necessary. This afterward became the first year of the late four-year course. Now this preparatory work is to be relegated to the colleges and the original idea of the founders is to be given another trial. And again, we call upon the faculty of Columbia College for this necessary work.

In a school for the training of engineers—the men who do things—the instruction should be practical. We have often heard Chandler tell how he wandered from one college to another in this country trying to find an institution where he could be taught chemistry in a laboratory, how he obtained his wish in a measure at Harvard, but was finally compelled to complete his education in Germany.

When the School of Mines was made ready for students, the first thing done by Chandler was to provide chemical laboratories—qualitative, quantitative and assay laboratories. Egleston had from the beginning his blowpipe laboratory and his students' collection of minerals in open drawers, as well as the show collection under glass. Vinton had his drafting rooms where the students were taught to make wonderful working drawings like Joseph's coat, in many colors.

What has been done since in laboratory equipment is familiar to everyone here present—engineering laboratories, civil, mechanical, electrical, chemical, metallurgical and mining. The summer work in surveying, in geology, in metallurgy and in mining is but an extension of the same idea.

It is not yet certain that we have exhausted the possibilities of this sort of education. It was 34 years after the founding of the school before we had laboratory instruction in physics. It will perhaps be equally long before we have laboratory work "elbow teaching" in mathematics to train the young idea, for example, to visualize mathematical conceptions involving three dimensions (and perhaps, who can say, extend such teaching to the "fourth dimension!"). I find students whose mental vision seems to be limited to a single plane, and to whom the third dimension is almost as unreal as is the fourth dimension to the rest of us. In many other ways laboratory teaching in mathematics may prove desirable.

Not only in its laboratory and field instruction, but also in its presentation of the different subjects taught, is the School of Mines practical. Chandler's course in applied chemistry, with the Chandler museum illustrating this subject, Professor Newberry's lectures on economic geology, and his collection of ores and useful minerals, are good examples. The traditions thus established have been followed in other departments, and the School of Mines is preëminently a School of Applied Science.

Engineering the Basic Requisite for Mining Men

A mining engineer must first be an engineer (it almost goes without saying). This has not always been recognized. When the school was organized there were few real mining engineers in the country, but many mining experts, mostly geologists. The mines were managed by so-called practical men, and the engineering was "rule of thumb" and in the hands of boss carpenters, machinists and blacksmiths. It was fortunate that Egleston and Vinton were graduates of the Ecole des Mines of Paris and that Vinton, Peele and Trowbridge were graduates of West Point. It was most fortunate for the reputation and usefulness of the new School of Mines not only that these men were engineers, but that they had the courage of their convictions and adopted the educational traditions of the old world, instead of adapting their teaching to the existing practice of the new. The school would have been much more popular had the training been less strenuous. It would, however, never have attained its present influence and prestige.

While the School of Mines was thus organized from the beginning as an engineering school, with instruction in higher mathematics, physics, mechanics, etc., the courses in engineering were not given the prominence they deserve, and that they now have, until 1877, when Professor Trowbridge first took charge of that department with Hutton, Crocker, Mayer, Pupin and Munroe as assistants. As an engineer, the mining engineer is called upon to design structures, headframes, bins, trestles, framed buildings; to construct reservoirs and ditch and pipe lines for water supply; to lay out roads, railways, engine and gravity planes and ropeways for the transportation of mineral; to choose intelligently, and sometimes design, machinery for mining, pumping, ventilating, hoisting and milling, and to design power plants to operate such machinery.

Mining engineers must therefore have instruction in civil, mechanical and electrical engineering, as well as in the many special engineering problems involved in the development and operation of mines.

Exacting Requirements of a Mining Engineer's Education

A mining engineer must, of necessity, be a mineralogist, geologist, and something of a metallurgist. All these subjects demand most thorough instruction in fundamental subjects—mathematics, chemistry, physics, mechanics, hydraulics, thermodynamics and the like. You will all

remember your first and second years in the School of Mines as burdened with these subjects.

With the development of civilization and the new applications of science to the daily affairs of life, new demands are made almost every year for more detailed instruction in these fundamentals. The teaching of chemistry, physics and mechanics is today much fuller and more exacting than it was 10 years ago, and another 10 years may see further demands and further development in the same direction. Perhaps two and one-half, perhaps three years, may soon be required for fundamental science subjects. Who can tell?

From an educational standpoint, the training in an engineering school must be broad and thorough in these fundamental subjects. Nothing can be permitted to interfere with this. As the course becomes more crowded, we shall have to devote less time to the professional subjects and perhaps omit many of them altogether.

From the beginning, the founders of the School of Mines determined that it should be strictly and solely a professional school. All subjects of a non-professional character, language, literature, history, philosophy, economics and the like, have been rigorously excluded. French and German were for a time included (on account of their usefulness), but later were made requirements for admission. This policy has been maintained to the present day. Other engineering schools almost without exception devote about one-fourth of the student's time to non-professional subjects and as a result weaken their professional training very seriously, and this without fully accomplishing the object desired. One year out of four is not enough time for liberal studies. It is, of course, true that our graduates are more or less handicapped by the lack of this training unless they get it elsewhere, at home, at school, in college, or by their own efforts.

In 1891, when I was promoted to be the head of the new department of mining, it occurred to me that this lack of general and broad culture, so necessary for one who aspires to be a leader in his profession, could be overcome by a larger proportion of our students if they could be encouraged to attend a college before coming to the professional school. A small number of our students have a first degree on entering, and a larger number have one, two or three years of collegiate work to their credit. To take both collegiate and professional degrees then required eight years. By special arrangements at Columbia and elsewhere, the time could be shortened to seven years without losing the first degree.

The Six-Year Course at Columbia

The work of the first and second years in the School of Mines' four-year course was wholly of a collegiate character—mathematics, chemistry, physics, mineralogy, geology, elementary surveying and the like. There seemed to be no reason why these subjects should not be counted for the first degree and the combined course shortened to six years. A schedule of study was drawn up on these lines and submitted to my colleagues in the university, including among others Professor (now President) Butler. The idea received immediate acceptance in theory and six years later, on removal to the new site, was put into operation. For eight years this combined six-year course has been taken by a few students each year. Next year the six-year schedule will be in force for all students who may be candidates for engineering degrees.

At first the number of students will be much less than at present. The trustees have made the experiment with full knowledge of the financial sacrifice involved. It is a bold step, and one in which the outcome is uncertain. There can be no question as to the wisdom of the new course from an educational standpoint, if the loss of income does not involve and make necessary economies which will affect the efficiency of instruction. No such economy is at present contemplated and we hope none will be necessary. In an educational institution increase in numbers usually increases the deficit. The education of each student always costs more than the fees paid. With few students, the annual deficit should be less.

The Lecture System Discussed

In conclusion, I should like to say a few words as to instruction by lectures. All my academic life I have been a lecturer. No one is more familiar with the defects of the lecture system, or with its great usefulness. The chief disadvantage lies in the necessity for taking notes. But few students are skilled stenographers. If they are, their whole attention is devoted to recording the words as they fall from the lecturer's lips and the brain fails to apprehend or record the ideas conveyed. If the student takes "long-hand" notes, he must condense and so the brain takes temporary cognizance of the ideas. The more the student listens and the less he records in his notebook, the greater the impression left in his brain at the end of the lecture. The best results undoubtedly are secured by taking no notes and writing a summary afterward. I think it important, however, that the student should make his own summary. If a printed syllabus is provided the average student pays less concentrated attention to the lecture, and the better and more complete the syllabus, the more he learns to depend upon it and the more he allows his mind to wander; or, if he follows both the syllabus and the lecturer, the printed word makes the greater impression on the brain and the spoken words are largely forgotten. With a perfect and complete syllabus, the lecture is almost, if not quite, unnecessary.

The principal advantages that may be claimed for the lecture system is that it is always up to date. The lecturer, if he is alive, will give the student the last word on the subject treated. This is especially important in engineering topics, in which every week some advance in practice is recorded in the technical press. In the case of a printed book, the proof sheets are hardly corrected before some modification or correction should be made. To bring a book up to date requires a lecture or more to supplement each chapter. The book then becomes only a less perfect syllabus.

Another advantage that can be claimed for the lecture is the possibility of elaborate illustration. If many cuts, figures, tables, formulas or other illustrations are printed in a book, the mind of the reader is confused and strained by referring back and forth from text to illustration, and much energy is wasted and time lost in endeavoring to establish the desired correlation. In a lecture the eye of the student can remain fixed on the diagram or blackboard, while his ear receives the explanation. In a lecture it is possible to have many diagrams on the wall and refer to one or to several at will, to illustrate the ideas to be

conveyed. This would be impossible in a book without greatly fatiguing the reader.

Another advantage, and not the least important of the lecture system in good hands, is the saving of the students' time. To compile the lecture, the instructor has spent many hours in reading. A single line may represent an hour's work. If the student is required to obtain the same information, he will probably consume much more time and get only a confused and contradictory impression as the result. It is true that it is necessary for the student to learn to read intelligently and to draw accurate conclusions from what he reads. This is in itself a valuable and necessary part of his education. He should, however, not be compelled to get all of his information from library research.

Reading should supplement the lecture and should be subordinated to it. The principal disadvantage of the "case system" of teaching law and of book research in graduate work is the great expenditure of time required and the imperfect results obtained. The case system must be supplemented by recitations and lectures and the research work by seminars.

With the crowded condition of our engineering courses, in which the economy of the time of the student is of prime importance, and in which we must secure the maximum result from every hour of the student's work, the lecture system has always played an important rôle and will always continue to be one of the most valuable methods of imparting knowledge. Textbooks, recitations, laboratory work, reading and research should all be used, each in its proper place, but lectures should also be freely employed as giving greater results for the time expended by the student than any of the other methods.

Contact between Lecturer and Student

Finally, the contact between the lecturer and the student and the personal influence that may be exerted by the instructor, while present in any good form of teaching, are perhaps most effective in the lecture. Certainly in no other way can the teacher impress himself on so many in so short a time.

Many years ago Mr. Alexander L. Holley, the eminent metallurgist, read a paper on the "Inadequate Union of Engineering Science and Art." This was followed by a joint discussion by members of the several engineering societies on "Technical Education," which was afterward published in book form.

One result of this discussion was the establishment of the "Summer Class in Practical Mining" at Columbia in order to bring mining students into intimate contact with the art of mining during their professional course. In Germany, all mining students are required to spend several months in practical mining work, with considerable emphasis on manual labor, before beginning their professional training.

The summer school has proved of great advantage, as most of you will testify, but the inadequate union between science and art still obtains. Unless the graduate of the School of Mines goes through some sort of apprenticeship in practical mining, he will have indifferent success as a manager and will quickly become reduced to the ranks of "consulting engineer," in which at present the supply greatly exceeds the demand.

During the past 30 years or more, I have given much thought to this subject, and have made several tentative experiments at a graduate school of practical mining on the lines of the apprentice schools which have been established by several large corporations. None of my experiments have been altogether successful, and I question whether any such school will be of great value unless under the joint direction of an enthusiastic and capable instructor and a hard-headed and rigorous business manager. These two must work together. The apprentice must no longer be a student whose interests are all important, but he must be a wage earner, who gives full value for the wage paid. The latter result cannot be secured in any work solely under academic direction. On the other hand, the apprentice must not be looked upon primarily as a wage earner, and ruthlessly used as a cog in the machine, but he must be treated also as a student and his work so organized as to give him the necessary practical training in the shortest time. It must be recognized that his training is to make him an executive officer, and that it is a waste of time to try and make him a skilled workman.

The best results so far have been secured when the enthusiastic instructor and the hard-headed business manager are one and the same person—when an officer of the company can be induced to take the graduate as an apprentice. Unfortunately, but few mine officials have the time, the training, the sympathy and the inclination to undertake this work.

The next best thing, and one which will serve a larger number of young graduates, will be for some one or more mining companies to organize apprentice schools and delegate the supervision of the work to a competent officer of the company, who will serve in the double capacity of enthusiastic instructor and hard-headed business manager, at least, so far as the apprentices are concerned.

Such an apprentice school should prove valuable to the mining company, as well as of inestimable worth to the profession.

American-Foreign Refugees Club

A club, the American-Foreign Refugees Club, has been recently organized in El Paso, Tex. The object is to form a meeting place for American and foreign refugees from Mexico, and others interested, where they can receive daily news and reports of the state of affairs in the Republic. The society is to be nonpartisan and nonpolitical, and a reading room will be maintained. In this will be kept files of the leading daily papers of Mexico City and such other cities in Mexico from which periodicals can be obtained. There will be copies of the official journals from the capitals of each state, giving the latest decrees, tax impositions, assessments, and other pertinent details. Information of all kinds pertaining to Mexico, its laws and tariffs, will be kept for reference.

A register of the addresses of all Americans and foreigners in Mexico is being kept as far as possible, and all those coming in from there are requested to call and give the club the latest news of the section from which they come. There are small fees collected from members for maintenance of the institution.

Many persons have come from Mexico without resources, and these the club has made efforts to assist in every possible way.

Editorials

The Situation in Spelter

Last week the price for spelter rose above the price for copper, an event unprecedented in the history of the metals. Moreover, it occurred at a time when the price for copper was high—about 18½c. Previous to the war a normal price for copper was commonly considered to be about 14½@15c., for spelter about 5@5½c. What has led to this extraordinary, surprising development and what will result from it?

It is unnecessary to review the conditions that caused Europe to turn to America for a large supply of spelter, or the statistical position, or the shortage of smelting capacity—all of which has been done previously and exhaustively. The matter of chief interest is what has happened during the last three months.

In the early days of March, following large buying from abroad in January and February, the price for spelter had risen to about 10c. That price was regarded as dangerously high by almost everybody of long experience in the industry, and when the demand abated in a rather ominous way, the transactions during the middle fortnight of March having been very light, there was a sharp recession in price, and it was thought that a collapse was threatened then and there. Toward the end of March, however, a strong demand began to reappear, attaining great force in April and increasing during May. This demand emanated especially from ammunition manufacturers in this country and in Canada. There was also buying from abroad, but it was less in volume than the domestic.

The ammunition manufacturers had come into possession of huge contracts for cartridges, shells and shrapnel and required a large quantity of spelter for making the brass used in those things. Their contracts promised to be immensely profitable. The metals, at any reasonable price, constituted but a relatively small part of the cost of manufacture, and when their purchasing agents went into the market to buy them, there was no haggling about price, which was a subordinate consideration, and no disposition to lie low and buy conservatively. On the contrary, the thought and the policy seemed to be "We have a contract to deliver so many shrapnel, beginning in July and ending in December, which is going to require so many tons of spelter. Contract now for all of that spelter, at any price, for deliveries corresponding to our own deliveries of the finished product and rid our minds of the raw material question." With respect to the kind of spelter to be bought, the ammunition manufacturers simply repeated the specifications of the military authorities. It was not their part to ask questions or discuss reasons why. If they were told to use spelter assaying 99.95% Zn, they went into the market to buy just that kind, and no other. The ordinary classifications of spelter as high grade and intermediate were practically abolished, specifications becoming for particular brands or for guaranteed zinc content narrower than the customary limits of the trade.

With such a demand the market became one of sellers' terms, and often a buyer—making specifications that only a few sellers, or perhaps only one, could meet—was required to pay what looked like, and in fact was, an extravagant price, but which created a new precedent and constituted a new point for everybody to cap the next day. A buyer needing a considerable tonnage of spelter for delivery during June, July and August might find only one seller who could supply it, whose terms might be that an equivalent quantity for the next following three months be taken at the same price. Another buyer needing intermediate spelter might find that he could get it only by taking the same quantity of prime western, both at fancy prices. The ammunition manufacturers were indifferent as to this; not so, however, those galvanizers, users of spelter for peaceful purposes, who were caught in the maelstrom.

These developments put the producers in quite a different position from what they occupied during the first quarter of the year. During that time there was a shortage in the supply of spelter for prompt delivery and more or less difficulty in selling ahead. Buyers, having no confidence in the rise already experienced, were reluctant to commit themselves to contracts running far ahead. In so deferring their purchases, however, they found themselves later compelled to pay large premiums to those producers who could supply prompt spelter, and in the end had to do just what they had sought to avoid. As for the producers there were great differences in the averages of sales according to whether they had sold ahead liberally or had not.

In the second quarter there came a change. The demand for deliveries far ahead—to the end of 1915 and even into 1916—arose and producers were delighted to be able to sell thus at the high prices offered, and nobody considered it desirable to confine his sales to near-by deliveries with the hope and expectation of realizing even higher prices later. The purchases of galvanizers, especially interested in near-by deliveries, dwindled, while as for the ammunition manufacturers, the later deliveries were in many cases what they wanted particularly. Business in prompt and near-by deliveries became insignificant, confined to belated consumers who required relatively small quantities. The producers were of course able to supply those, for no smelter will contract for the delivery of all he expects to make in any month, considering accidents that might happen, and as each month ends the reserve for safety is released and may then be peddled out at a premium.

The situation that has developed in spelter is of course paralyzing for the industries using spelter for peaceful purposes. From all quarters come the reports of the use of bright wire instead of galvanized and of black sheets instead of galvanized. The manufacturers are urging their customers to make those substitutions. If black sheets, to be painted, can not be used, try terne plate, or use something entirely different, e.g., instead of galvanized

pails use wooden or paper ones. Some galvanizers are already discontinuing the manufacture of galvanized goods. Yet the crest of the wave has not yet broken upon the manufacturers in full force, for while spelter is now above 20c. per lb. the smelters are still delivering spelter that they sold in March and earlier at 8@9c.

What is going to be the outcome of this situation? It is dangerous to venture any prophecy in view of the extraordinary conditions, the destruction of all land-marks, that have resulted from the war. The events of the last week do not indicate that the climax in spelter has yet been reached. Nevertheless, we are not over bold in imagining that it can not be far away; nor in imagining that when the contracts covering the spelter needed in filling the ammunition contracts have been placed there will be a cessation of the furious, reckless buying that has characterized the last few weeks. However, while the war lasts we shall no doubt see high prices for spelter, even if not so high as now. But looking ahead to the end of the war we are going to see some day the possession of an enormous smelting capacity, completely equipped for operation, which will be available for the supply of consumers who are now being trained by force of circumstances to use other things as substitutes for spelter, with the danger that they will find some of those substitutes to be better than spelter and will not want to return to the use of the latter anyhow.

Mexico

At last there is to be a change from the policy of "watchful waiting" with respect to Mexico. It is high time. For many months there has been no organized government in Mexico. The currency of the country is sadly depreciated. In many parts of the country the people are starving. Nowhere is there safety for life and property. The unhappy land is in a state of chaos.

Now humanity dictates that the United States send help to the suffering. Self-interest—self-interest of the ingenuous kind—dictates that we protect ourselves against disease originating in Mexico and relieve ourselves from border disorders.

We know not how any new policy to effect what we shall insist upon can be anything less than a policy of intervention. The administration seems to be making up its mind for that. About ninety-nine per cent. of those who really know Mexico have prophesied this from the beginning of the post-Huerta days.

Lake and Rail Lines

The decision of the Interstate Commerce Commission that the steamer lines on the Great Lakes which are operated by railroad companies come within the definition of competing rail and water lines is bound to cause some disturbance in the Lake trade. The ownership of a comhibited by the incidental clauses of the Panama Canal act, hibited by the incidental clauses of the Panama Canal act, and the Interstate Commission holds that the railroads must divest themselves of such ownership at an early date. The only exception made is in the case of certain car-ferry lines on Lake Michigan and Lake Huron, which are held to be, not competing lines, but simply extensions of the railroad line.

This decision, however disturbing it may be to some lines, does not affect those engaged in the transportation of iron ore. The boats in that business are not owned by the railroads, but generally by various steel companies. Moreover, the railroads do not compete for the business of carrying ore from the Lake Superior region to the Chicago or Pittsburgh iron districts. The vessels owned by the steel companies have practically driven the independent boats out of the ore business, but they have done so by their greater size and other advantages, and there has been no question of competition such as arose in connection with the carriers of grain and general freights.

Coal rates on the Lakes are another question; but that is settled by the fact that east-bound freights are largely in excess of west-bound, so that there is always a surplus of tonnage available for coal and rates are always low.

Tin Smelting in the United States

At last the United States is to have a tin-smelting industry. The American Smelting & Refining Co. is now erecting at Perth Amboy a plant that is expected to produce 3000 to 5000 tons of tin per annum. This will be supplied chiefly with ore bought in Bolivia, but parcels will no doubt be obtained also from other sources. It is expected that the new plant will be ready for operation about the end of this year.

The position of the United States as the world's largest consumer of tin and as the producer of none has often been discussed, and it has also been hoped that Bolivian tin ore would at some time be brought here for smelting. We shall now hope that the new enterprise will be so successful that eventually the entire output of Bolivia will come hither.

The Birmingham Water Line

An event of considerable importance to the Alabama iron and coal region was the completion last week of Lock No. 17 on the Black Warrior River. This lock completes a system of improvements giving a depth of 6 ft. at all stages from Lock No. 17 to Mobile Bay and securing the free passage of barges of considerable size and tonnage. Arrangements have already been made for the shipment of coal from the Alabama mines to Mobile by this route. The head of navigation is 18 miles from Birmingham, and a few miles of railroad are still to be built, the completion of which will enable the Birmingham and Ensley mills to use this route to tidewater. This will give them, it is expected, a cheaper freight on export material than they now have.

This connection with the Gulf of Mexico will present especial advantages for trade to South America and through the Panama Canal. The organization for trade to the Gulf is well advanced, and the completion of the short railroad line is now the only thing to be pushed.

Last week was signalized by the price for Utah copper shares passing that for Amalgamated, something that had long been expected. It happened in the nick of time, for Amalgamated is soon to disappear. Utah increased its dividend from the rate of $3 per annum to $4. There was difference of opinion about this, we understand, one party in the board of directors desiring to

defer the increase. There is no question that Utah is earning what it is paying, and more; but certain important members wanted to see it not only in a position to be free from borrowing any money on its copper above ground, but also to have a large cash surplus in addition to what is required for carrying the copper.

BY THE WAY

Prior to the formation of the Goldfield Consolidated, $11,200,000 was taken from the constituent properties by leasers. Since then the Consolidated has produced approximately $50,000,000, from which dividends amounting to $27,398,215 have been paid, while it is hoped that the end is not in sight by many years and dollars.

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A recent refugee from Southern Mexico brought with him a book, probably from some old library that had been looted, treating of ancient metallurgy. The book has been left with the American-Foreign Refugees Club, Coles Bldg., El Paso, Tex., and anyone interested may have full details by addressing that society. The complete introduction to the work is as follows:

"ARTE DE LOS METALES, en que se enseña el verdadero beneficio de los de oro y plata por azogue. El modo de fundirlos todos, y como se han de refinar y apartar unos de otros.

"Compuesto por el Licenciado Alvaro Alonzo Barba, natural de la Villa de Lepe, en la Andalucia, Cura en la Imperial de Potosi de la Parroquia de San Bernardo. Nuevamente ahora añadido. Con el tratado de las antiguas minas de España, que escribió Don Alonzo Carrillo y Laso, Caballero del Avito de Santiago, y Caballerizo de Cordova.

"Publicado en Madrid, con aprobacion de los diputados de la Villa de Potosi en Marzo, 1637, tambien aprobacion de Don Paulo de Barondelet."

The book has 232 pages with 125 chapters, illustrations of tools, assay furnaces, smelting tools and furnaces, etc.

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Portland Buys Stratton's Independence

At the meeting of Stratton's Independence, Ltd., in London on May 17, the sale of this Cripple Creek mine to its neighbor, the Portland Gold Mining Co., was approved by the Stratton shareholders, with only one dissenting vote. The agreement of Mar. 20, 1915, offering the property to the Portland company was the outcome of negotiations on behalf of Stratton's Independence to purchase the Portland dumps. The Independence mine was no longer able to assure an ore supply for the mill, and the inability to secure sufficient dump material, unless the Portland company were willing to sell, left Stratton's Independence with a mill and no ore. Accordingly, the offer of the Portland company of £65,000 for the property was put before the stockholders and accepted by them. The Portland Gold Mining Co. will assume charge of the mine and mill on July 1.

The output of the mine during its existence to the present day, according to the chairman's address, as reported by the *Financial Times*, has been approximately $23,573,500. This output was obtained: (1) By Mr. Stratton when working the mine himself, $3,985,440; (2) by the old Stratton's Independence Co., $15,064,320, and (3) by Stratton's Independence, Ltd., $4,523,740. The old company paid in dividends $4,748,989, which represented 31.5% of the value of the ore produced. In 1908, when the old company found itself owing in America about £25,000, Stratton's Independence, Ltd., was formed and it was decided, on the recommendation of Consulting Engineer Philip Argall, to erect a mill to treat the dumps and, at the same time, to get what ore could be obtained in the mine, the workings of which were badly caved. Exploration in the mine has from time to time been rewarded with some rich ore, but no large tonnages have been found. The most noteworthy achievement of the later years was the success attained by the mill, which exceeded the hopes entertained for it by Mr. Argall.

The stockholders now face the problem of disposing of the surplus, of which it has been proposed to apply about £20,000 to the purchase of a new property. The question of a new property has been previously referred to in these columns, and a poll is now being taken to determine the wishes of the stockholders.

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May Mining Dividends

Dividends paid in May, 1915, by 21 United States mining companies making public returns amount to $1,564,144, as compared with $1,826,064 paid by 22 companies in May, 1914. Industrial and holding companies allied to mining paid $8,335,435, as compared with $9,568,895 in 1914. Canadian and Mexican companies paid $558,540 in May, 1915, and $1,778,960 in May, 1914.

The totals for the first five months are as follows: Mining companies, $15,410,388, as against $25,515,566 in 1914; metallurgical and holding companies, 1915, $26,731,200, as against $38,769,096 in 1914; Canadian and Mexican mines, 1915, $4,180,364, as against $8,876,332 in 1914.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g	Alaska	0.20	36,000
Alaska Treadwell, g	Alaska	1.00	200,000
Alaska United, g	Alaska	0.40	72,080
Arizona, pfd. A, c	Ariz.	0.17	57,688
Bunker Hill Con., g	Calif.	0.02½	5,000
Bunker Hill & Sullivan, l.s	Idaho	0.25	81,750
Caledonia, l.s	Idaho	0.02	52,100
Champion, c	Mich.	1.00	100,000
Ducktown, c	Tenn.	0.24	48,600
Golden Cycle, g	Colo.	0.02	30,000
Hecla, l.s	Idaho	0.02	20,000
Homestake, g	S. D.	0.65	163,254
May Day, g.s.l.z	Utah	0.03	24,000
Miami, c	Ariz.	0.50	373,380
Nevada Wonder, g.s	Nev.	0.05	70,415
Parrot	Mont.	0.15	34,477
Shattuck-Arizona, c	Ariz.	0.50	175,000
South Eureka, g	Calif.	0.03	9,900
Terrible, g.s	Colo.	0.06	6,000
Wasp No. 2, g	S. D.	0.00½	2,500
Yellow Aster, g	Calif.	0.02	2,000
Iron, Industrial and Holding Companies			
Amalgamated, c	U. S.	0.50	1,154,159
Cambria Steel, pfd.*	Penn.	0.62½	562,500
International Nickel, com	N. J., Can.	2.50	948,133
International Nickel, pfd	N. J., Can.	1.50	133,689
St. Mary's Mineral Land	Mich.	1.00	160,000
U. S. Steel, pfd	U. S.	1.75	6,304,919
Warwick, I. & S	Penn.	0.35	52,035
White Knob Copper & Dev., g	Calif.	0.10	20,000
Canadian, Mexican and Central American Companies			
Coniagas, s	Ont.	0.30	240,000
Dominion Steel, pfd	Can.	1.50	105,000
Hollinger, g	Ont.	0.20	120,000
Le Roi No.2	B. C.	0.24	29,160
Lucky Tiger, g.s	Mex.	0.09	64,380

* Scrip.

PERSONALS

F. R. Weekes has gone to California on examination work.

Fred T. Williams, of Salt Lake City, is in Arizona on professional business.

Edwin E. Chase will be at Silverton, Colo., during the first two weeks of June.

George M. Packard, of Boston, is at Gold Lake, Manitoba, in the interests of the Calumet-Corbin Mines Co. of Boston.

Horace V. Winchell announces the removal of his office to 826 First National-Soo Line Building, Minneapolis, Minnesota.

C. V. Drew has returned from Peru where he has been for several months in the interests of the Cerro de Pasco company.

A. J. Bennett, of the Backus & Johnston Co., Casapalca, Peru, arrived in New York last week and will spend some time in the United States before returning to Peru.

Lieut. James Gordon Ross, lately consulting engineer of the Milton Hersey Co., Montreal, who is a machine-gun officer in the Canadian contingent, was wounded in a recent engagement.

A. C. Ludlum, of the New York Engineering Co., has gone to Colorado to inspect the dredge which the company is building on the Derry ranch in the Arkansas River valley, about 10 miles from Leadville.

J. H. Lane, Uniontown, Penn., has been named general superintendent of the three coking plants of the Oliver & Snyder Steel Co., Pittsburgh, succeeding the late Fred C. Keighley. Mr. Lane formerly was superintendent of Oliver No. 3 plant.

G. F. Streich, superintendent of the former Cockerill Zinc Smelting Works, and E. J. Bondy, former agent of L. Vogelstein & Co., are in charge of the Bruce smelting plant at Bruce, Kan., which are leased and operated by the Cherokee Zinc Co., of Cherokee, Kansas.

Baron Von Polenz, who has been extensively interested in Cobalt and Porcupine properties for the last three years, has been placed under arrest as an alien enemy and interned at Fort Henry, Kingston, Ont. He was formerly a captain in a Saxon cavalry regiment.

O. B. Perry, general manager of the Yukon Gold Co., left New York last week for San Francisco. After inspecting the company's dredging operations in California, Mr. Perry will proceed to the Northwest where the company has a dredging operation at Iditarod, Alaska, and both dredging and hydraulicking operations in Yukon Territory.

C. E. Weed has been appointed underground mining superintendent at the Lake property, in the Lake Superior copper district, which is being unwatered under the general management of Elton Walker. Mr. Weed has been mining superintendent under George Hooper at the Victoria for several years. He is a graduate of the Michigan College of Mines.

Lincoln G. Eakins, former assistant general manager of the Colorado Department of the American Smelting & Refining Co., has recently been appointed successor to Franklin W. Guiterman, general manager of the company, who died several weeks ago in New York. Mr. Eakins also succeeds Mr. Guiterman as president of the Carbon Coal & Coke Co. Mr. Eakins has returned to Denver from New York.

V. D. Callaghan, who resigned as superintendent of the H. C. Frick Coke Co., at Lemont, Penn., has been succeeded by T. H. Doorley, superintendent of the works at Marguerite, and he has been succeeded by E. S. Wolfersberger, of Hecla, in turn succeeded by Robert Ramsey. G. W. English has been promoted from superintendent at Oliphant to Wynn, and J. A. Childs, superintendent at Juniata, has been named superintendent at Bitner also.

OBITUARY

Joseph G. Beale, 77 years old, a prominent gas-well operator, and well-known in the steel trade in western Pennsylvania, died last week in Pittsburgh.

Charles F. Albrecht, 56 years old, former superintendent of the Painter mills of the Carnegie Steel Co., Pittsburgh, died at his home in that city last week. He had been connected with the Painter plant for 35 years.

Pierre Martin, whose death at Sireuil, France, was briefly noted in our last issue, originated the use of scrap steel in the openhearth furnace in making steel, now generally employed. Mr. Martin was honored with the award of the Bessemer gold medal by the Iron & Steel Institute on May 13, a few days before his death.

John T. Hodson, a well-known mining operator of Salt Lake City, died May 27, as the result of being struck by a street car a few days previous. Mr. Hodson organized the Nevada Hills Mining Co., and was one of the pioneers in the Bull Valley (Goldstrike) district. He was also interested in mines in the Cottonwood section of this state, and in Nevada and Idaho.

Henry Wickham, aged 70, died recently at his home in Philadelphia. Mr. Wickham was a former resident of Connellsville, Penn., a builder of the Trotter plant, of the H. C. Frick Coke Co., and one of the first coke plant managers of the Connellsville region. In 1884, the Trotter plant was sold to the Frick company, and Mr. Wickham retired, going to Philadelphia.

Patrick H. Meagher died at Deer Lodge, Mont., May 19, aged 73 years. Born in Canada he went to California when 19 years old and after several years spent in mining there and in Nevada he went to Confederate Gulch in Montana in 1865. He continued to mine there and elsewhere in Montana for many years, also owning a fine ranch in the Deer Lodge Valley. He leaves three sons and five daughters.

Edwin Miles died in Pittsburgh, Penn., May 25, aged 97 years. Born near Valley Forge, Penn., after some years spent in teaching at Huntington he went to Pittsburgh in 1846. After some years with the Schoenberger Iron Co. he became a partner in the Black Diamond Steel Works and later in the Duquesne Iron & Steel Co. He retired from active work about 20 years ago. He was the last survivor of the earlier generation of Pittsburgh steel operators.

SOCIETIES

Worcester Polytechnic Institute—The commencement exercises will be held at Worcester, Mass., June 6-10. The Commencement address will be delivered by Dr. Richard C. Maclaurin, president of the Massachusetts Institute of Technology.

Canadian Mining Institute—The Cobalt branch had an excursion to Porcupine on May 17, which was attended by about 25 members including Dr. Frank D. Adams, of McGill University, J. B. Tyrrell, of Toronto and W. H. Collins, of the Canadian Geological Survey. Visits were made to the principal mines and on May 18 a meeting was held at which it was resolved to revive the Porcupine branch which has for some time been dormant. All the mines of the camp were requested to appoint temporary representatives to an organization committee.

American Institute of Mining Engineers—The annual meeting of the Pennsylvania Anthracite Section will be held at Lansford, Penn., June 11, 1915. The following tentative itinerary has been arranged: At 10 a.m. Hauto: Visit the Lehigh Navigation Electric Co.'s power plant and Panther Valley Water Co.'s hollow buttress dam at Bear Creek, or the Hauto washery. Lansford: Lunch at Old Company's Club House as the guests of the Lehigh Coal & Navigation Co. A business session of the Section will follow the luncheon. The nominating committee nominates for reëlection the present officers and Executive Committee. Afternoon: Inspect electrical hoisting at No. 11 Shaft; new features at No. 10 Breaker; new timber-cutting mill and yard, substation and electric hoists at No. 5 Colliery; and other operations of the L. C. & N. Co. as time permits.

INDUSTRIAL NEWS

Philip N. Case will in future be in charge of all mine-car applications of the Hyatt Roller Bearing Co., traveling in the western part of Pennsylvania or Ohio and West Virginia. Mr. Gleisen, who formerly covered this territory, will travel in the eastern part of Pennsylvania, New York and New Jersey.

The Nordberg Manufacturing Co., of Milwaukee, Wis., announces that E. W. Swartwout, formerly of the Chicago office, will be associated after June 1 with Mr. MacLaren in the New York office of the company. Enlarged offices have recently been taken in the new Equitable Building (120 Broadway), New York. The Chicago office will be in charge of John E. Lord.

Editorial Correspondence

SAN FRANCISCO—May 30

Lassen Peak Burst into Violent Eruption again May 30. Another flow of boiling mud is pouring down the sides of the volcano. Fears are felt for the safety of many investigators known to have been in the danger zone. The mud flow took the direction of Lost and Hat creeks. It was along these creeks that previous devastation was wrought. This eruption is the first since the destructive outbreak of May 22 and marked the first anniversary of the peak as an active volcano. During this year there have been 99 eruptions including the present one.

Tentative Mine Safety Rules prepared by a committee of mining men at the request of the Industrial Accident Commission of California, have been printed and distributed to mining men of the state for suggestions respecting such changes as may be deemed necessary to satisfactory adoption and enforcement. The commission will hold a public hearing to consider the adoption of the rules. After this hearing and approval the authority for their adoption and enforcement will be about the same as for the enforcement of the inspection laws of other states.

Civil Service Examination will be held June 18-19, 1915, and from the list of men who pass the examination one or more deputy mine inspectors will be selected. H. M. Wolfiin, who has prepared the way for the application of safety rules, by visiting all the principal mines and offering suggestions as to betterment of conditions relating to the safety of working men, will occupy the position of chief inspector. His pay and expenses have been and will continue to be shared equally by the Industrial Accident Commission and the U. S. Bureau of Mines; the deputy inspectors will be paid by the State. Hence the practical operation of the safety rules will be not only in harmony with but under the supervision of the Bureau of Mines as well as the Industrial Accident Commission. In other words, the mines will be inspected by the dual authority of the United States and the State of California.

Investment in Gold Mines in California was greatly retarded and in some instances absolutely stopped in the early months of the war. Even development of mines already in progress was held up. This condition continued until March, when there was slight improvement and evidence of progress toward development of properties already undertaken. In April there were signs of life in the line of investment. Some inquiry was made for good gold properties that would stand the test of rigid examination and reasonable prices and terms of payment. Owners of gold mines desirous of selling, grown weary of the long delay caused by the war, became impatient over the apparent slow movement of men supposed to be ready for investment. The chief cause of the spirit of unrest seemed to have been the belief obtaining in the early period of the war that the conditions in Europe would of necessity require the investment in and rapid development of mines. Apparently the conclusion was logical. The same belief obtained regarding visitors to the Panama-Pacific Exposition. Now that the investment money seems to have loosened up a little in the past two months, the owners of gold mines are again in a state of jubilant hope, which is likely to be again deferred. The fact that recently the price of copper encouraged the resumption of copper smelting and incidentally improved gold mining encouraged the belief that investment in gold mines must inevitably and speedily follow. There was some improvement also in silver mining, with the probability that there will be a larger percentage of increase in silver than in gold production in California in 1915.

SALT LAKE CITY—May 28

Potash From the Alunite Beds near Edna crater are being investigated by Armour & Co., of Chicago, and its engineer, D. R. Thompson, just returned from Marysvale, 14 miles from Edna crater, states that development work will be begun in the near future. The Armour company is the next to the largest dealer in potash in this country, and as it cannot get potash from Germany under the contracts which it has with the German companies, it will have to get potash in the United States. The supply on hand is equal to the demand for this year, but next year, if the war continues, there may be a shortage.

The New Camp of Goldstrike, in the former Bull Valley district, 38 miles south of Modena in Washington County, is attracting more attention. A letter from the district describes the camp as having about 75 tents and cabins, and more being put up. There is a running stream through the camp, and plenty of timber, mostly cottonwood and cedar. The country is fairly rough, but nothing like Jarbidge. The ore deposits occur in limestone, although there is also porphyry. The Hamburg has a strong vein of high-grade well opened up, with a depth of several hundred feet. On the Hamburg a three-stamp mill is running two shifts on very rich ore. The mineralized area at present indicated is approximately four miles by ten. The road is bad, and there are no regular mails. Stage fare from Modena is $6 one way, and $10 for the round trip. The Salt Lake route is selling round-trip tickets from Salt Lake to Modena on account of the increasing travel.

New Mill for Tintic—The Dern interests will combine with the Knights in building a custom milling plant at Tintic to take the place of the Knight-Christensen mill recently destroyed by fire. With this in view, a consolidation of the Mines Operating Co. and the Knight-Christensen Metallurgical Co. has been practically completed—the new company to be called the Tintic Milling Co. The mill of the Mines Operating Co. at Park City will be dismantled, and shipped to Silver City where it will be used at the new mill, which will be built in the old Knight smeltery yard. The initial capacity is to be 200 or 300 tons daily, and arrangements will be made so that additional units can be added as needed. Both the Knight-Christensen and the Holt-Dern roaster will be tried out, and the one having the greater efficiency selected. The Holt-Dern roaster, successfully used on stope filling from the Ontario at Park City, and now treating American Flag ores at the Park City Mills, can undoubtedly be used for Tintic ores also. The difficulty at the former Knight-Christensen mill appears to have been in the mechanical part of the roasting. Officers mentioned for the new company are: Jesse Knight, president; W. L. Mangum, secretary and treasurer; G. H. Dern, vice-president and general manager. Work will be started on ores from the Knight properties; and contracts have been made which assure the new company enough ore to keep the mill in operation for some time. There is a large tonnage of siliceous ores at various Tintic properties, of too low-grade for shipment.

SEATTLE—May 29

Activity in the Interior and reports from Rex Creek indicate the mining operations are being carried on on larger scale than ever before. Bill Woodward on Rex Creek has tapped his pay channel after running through the rim 100 ft. and the prospects are bright. The R. A. M. Co.'s laymen are digging a ditch to run a ground sluice to their workings. They will have 125-ft. head on their nozzle. Brooks & Co. is building an automatic dam in Lucky Gulch, a tributary to Rex Creek off No. 10 left limit. Bert Carvey is one of the busy operators and is now running three shifts of men eight hours each on his ground and is taking out big money. Art Powell has developed a good paystreak on his ground on Fly Gulch and Slauser & Stantion expect to begin piping gravel shortly and T. S. Taylor is now driving his pipe preparatory to running gravel which is said to be high-grade.

Litigation and High Water are holding up development work to a large extent in the rich Healy River district and not much is expected in the way of shipments until the water subsides and the litigation over a number of the claims is settled. Practically all of Ruby and Kenyon creeks are tied up in the courts. However, there is considerable going on in the district not affected. Morgan and Hammer, on Kenyon Creek, had about 3000 sq.ft. of bedrock blocked out and were hoisting dirt when they were drowned out. They are working on the Mascot association claim. After the flood of water they moved their outfit upstream a short distance and started again to sink a shaft. They think on this ground they will be able to handle the water when bedrock is reached. John Hajdukovich working about 3000 ft. downstream, from where Morgan and Hammer worked all winter, reached bedrock at 147 ft. The same day he reached bedrock he drove a couple of points and the following morning he found the shaft flooded with water to within a few feet of the top. About 4000 ft. down-

stream from the Morgan ground Lawrence & Albrecht were sinking a shaft and at 200 ft. they struck water a little above bedrock and had to cease work and the same conditions have been met with by many of the operators owing to the abnormal amount of water in the creeks at this time.

The New Mining Law passed by the Territorial Legislature, supplementing the mining laws of the United States in Alaska and repealing the so-called Roden bill passed in 1913, which caused widespread interest in mining circles throughout Alaska, is probably the most important piece of legislation enacted by the governing body since its formation, and carries several radical changes which are of considerable importance in regard to future mining ventures in the North. It provides: That no association placer-mining claim shall be in excess of 40 acres and that on every association claim located since Aug. 1, 1912, not less than $100 worth of labor shall be expended in improvements or work each year for every 20 acres or fraction: That a survey of the claim or claims by the U. S. Mineral Surveyor shall constitute a credit on the annual assessment work: That no individual placer mining claim shall hereafter be more than 1320 ft. in its greatest length and that no association placer claim shall be more than 2640 ft. long: That powers of attorney must be filed before the filing of record of any location, that powers of attorney must be written and signed by those making them and that no one can act on a power of attorney for more than one person a month in one recording district: That an affidavit of assessment work completed shall be filed with the recorder of the district not more than 90 days after the first of every year. The failure so to file will constitute a forfeiture of the claims. Lode claims shall not be more than 1500 ft. long on the center line nor more than 300 ft. on either side of the center line. Tunnel rights on lode claims provide that the tunnel may be 3000 ft. long from the portal to the terminus but not more than this and shall be marked on the surface by monuments not more than 600 ft .apart. The sum of $500 must be expended each year in assessment work on each tunnel site. The proprietor of a lode claim or the owner of a quartz mill or a reduction works situated on the land proposed to be located may locate not more than five acres of nonmineral land as a mill site and during each year after the year of location and until patent is issued must do $25 worth of labor thereon or pay to the recorder the sum of $25 each year in lieu of such labor. Each location of lode claims must make an annual assessment equal to $100, all association claims doing $100 worth of improvement work for each location each year. Not more than two placer claims may be located in one recording district in one year by one party. One trouble with the old law which has been repealed was the difficulty of correctly complying with that portion which provided for the recording work. The new law is clear and is as follows: The certificate shall read as follows: (a) The name and number of the claim; (b) the name of the locator or locators; (c) the date of discovery and of posting of location notice; (d) the number of feet in length and width of claim; (e) it shall set forth the description with reference to some natural object, permanent monument, or well-known mining claim, together with a description of the boundaries thereof so far as applied to the numbering of stakes or monuments. This section is the same for placer claims and lode claims. The initial post shall contain the following in staking a claim, the name and number of the claim, the name of the locator or locators, the date of discovery and of posting notice on claim, the number of feet in length and width of the claim.

HOUGHTON—May 29

Only the Endorsement of the Shareholders of the Hancock Consolidated Co., at their annual meeting to take place in Hancock, June 16, is needed to consummate a deal between the Hancock and Quincy companies, which will result in doubling the production of the Hancock company, the reopening of No. 7 shaft, Quincy, and largely augmenting the Quincy's production. The agreement has been under consideration and discussion among the officials of the two companies for a good many months. There is every reason to believe it will go through. It will be another additional evidence of the prosperity of the copper country for it will mean the employment of at least 400 more men at the two properties. Briefly, under the five-year agreement, Hancock has the use of No. 7 Quincy shaft, half the working hours of each day. This makes it possible for Hancock to tap this rich, proven territory seven years earlier than otherwise for a subshaft would have to be built from the bottom of No. 2 shaft Hancock. Under the agreement the shaft will be sunk from the 60th to the 65th levels with 100 ft. left standing around the shaft for protection to both companies and from the 65th to the 71st, 160 ft. will be left standing for the same purpose. For these pillar protections the Hancock received $35,000 from Quincy. Quincy also buys 75 acres northwest of No. 7, over a mile from surface for $181,000. This land could not be mined inside of 20 years if the Hancock had to wait to get to it. It permits the Quincy to cut it with the shaft and into further territory of its own at once. The price paid for this is $2630 per acre, the highest price ever paid for mineral land in this district, at that depth. This land was purchased from the Canal company by the Hancock company for $500 per acre in 1906, so it looks like a good business proposition from the viewpoint of the Hancock shareholder. Considering the fact that Quincy recently purchased a parcel from New Arcadian at $800 per acre the price now secured is justified by the rise in the market for copper.

LORDSBURG, N. M.—May 30

Mine Taxation in New Mexico, as regulated by the recent legislature, is in the hands of a "State Tax Commission" consisting of five men appointed by the Governor of the State. The requirement of the new law is that this commission must prepare each year a book to be called the "Assessment Book of the Net Proceeds of Mines" in which must be entered the final finding and determination of the commission of all and singular, the mineral output of all New Mexico mines. The owners or lessees of mines are compelled to furnish the Tax Commission with these data. No improvements of any nature will be exempt and all surface improvements will be taxed in the same manner as other property of a like kind. All nonproductive patented mining claims and other nonproductive mineral lands known to contain valuable deposits in commercially workable quantities, shall be assessed and taxed upon the reasonable valuation thereof as undeveloped mineral lands in addition to their surface value for grazing, agriculture, timber or other purposes. In fixing such valuation it shall be the duty of the taxing officials to take into consideration the transportation facilities, distance from railroads and opportunity for marketing product of such ground. Any person or persons mining any character of mineral in New Mexico, under the new law, who shall fail or refuse after written notice from the Tax Commission to keep the accounts of mineral production and to forward same to the Tax Commission, shall be guilty of a misdemeanor and liable to a fine not to exceed $25 per day for each day's continuance of such failure or refusal, and also to a civil penalty of a like amount, to be used for and recovered in the name of the state, or to either such a fine or civil penalty as the Tax Commission may determine. Any member of the Tax Commission disclosing any information derived from the examination of the reports filed by the mining companies of New Mexico, is upon conviction subject to a fine of not less than one hundred dollars or not greater than two hundred and fifty dollars. Every such tax is made a lien upon the mines or mining claims. The Commission has begun its work but has not yet got into the mining division of the new legislation.

BALTIMORE—June 1

A Potash Manufacturing Plant, it is announced, is soon to be built in Baltimore by the United States Potash Co., which has been formed with a capital stock of $250,000. The officers are: Samuel Morrison, president; Andrew J. Barron, vice-president; Frederick Kirsch, secretary and treasurer. It is expected that the business of manufacturing potash will be in full swing within six months. The new plant will be located on the tidewater.

TORONTO—May 29

Oil Is Now Being Commercially Produced and refined at the well No. 2 of the Alberta Consolidated in the Calgary oil field. The first public demonstration of oil producing and refining was held on May 24 and was attended by hundreds of visitors. The well is producing a high-grade crude oil, stated to be equal to the best Pennsylvania oils, at the rate of 150 bbl. per day and with the installation of adequate pumping facilities the production is expected to be largely increased. At the refining demonstration it was shown that about 20%-gasoline can be refined from the crude oil exclusive of other products. An 8-hour pumping test is stated by Field Manager Stephenson to have produced 75 bbl. without perceptible diminution of the oil in the hole. The development of No. 1 well now some 2160 ft. deep is being proceeded with.

CHRISTIANIA—May 1

Old Copper Mine Reopened—The old Enighed copper mine at Högsfjord in Norway, which was operated as far back as 1760, was reopened last February and a consignment has been gotten out for shipment. The result of the exploitation shows persistence of ore along strike and at depth. There is also a large quantity of usable ore in the old dumps. The content is given as 8½% Cu and 16 to 17% S.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—Has placed orders for two 2500-hp. each hydro-electric generators. When these are installed a saving of $3000 per day will be effected.

CLIFF MINE (Valdez)—George C. Treat, E. Smith and Logan Archibald have commenced suit in district court at Valdez for 20% interest in Cliff Mine, pioneer quartz mine of Valdez. They allege that they advanced money for making test shipment to Tacoma smeltery under agreement whereby they were to receive one-fifth interest in claim.

AMALGAMATED OIL CO. (Katalla)—Owing to increased industrial activity in southwestern Alaska following starting of construction work on government railway from Seward, Amalgamated Oil Co., operating refinery at Katalla, has found it necessary to increase size of its plant. Present capacity is about 40 bbl. of gasoline and distillate per day. Several new wells are drilling and outlook for important developments are bright.

SPEEL RIVER POWER (Juneau)—That work of constructing large hydro-electric plant on Speel River, near Juneau, will be started at once is announced by corporation recently formed under laws of California for that purpose. It is planned to establish an electro-chemical factory on Norwegian plan, with special emphasis on fixation of atmospheric nitrogen. Ultimate capacity of Speel River is 100,000 hp., but only 10,000 will be developed at present. Kennedy & Lass, formerly of Treadwell staff, are among promoters of enterprise.

ALASKA GOLD BELT (Juneau)—Makeever Bros. have commenced work with crew of about 25 men on this property, more commonly known as Nelson-Lott mine, on which they recently secured option. Property includes area 12,000 ft. long by 3500 ft. wide adjoining Alaska-Gastineau on south, together with millsite on Gastineau Channel and tunnelsite from millsite to mine. Present crew is employed under direction of A. B. Todd in building compressor house, blacksmith shop, powder house and other small buildings at portal of adit in Sheep Creek Basin. A 600-ft. Ingersoll-Rand air compressor, driven by 100-hp. electric motor, will be installed. Present plans call for 5000 ft. of adit and drifts and large amount of diamond drilling. If satisfactory results are obtained from preliminary prospecting, for which sum of $250,000 has been set aside, company plans to drive a 2¼-mile adit from millsite on Gastineau Channel to tap orebody at depth of 3800 ft. and to build large mill about 400 ft. above sea-level.

ARIZONA

Cochise County

HUACHUCA GOLD (Courtland)—Jack Taylor, who has contract for deepening shaft, has 15 men at work. Cameron pump was recently installed.

Gila County

WARRIOR (Miami)—Warrior force now numbers 60 men and shipments of ore averaging 5 to 7% copper to the smelteries at El Paso and Hayden are regular.

INSPIRATION (Miami)—Underground work is proceeding regularly and during May ore hoisted exceeded any previous month's output. Scorpion shaft, only shaft through which ore is being hoisted at present time, is working to limit of its capacity, about 1000 tons per day. Plans are under way for construction of miners' change house of steel with concrete floors.

Maricopa County

NEW CORNELIA (Gila Bend)—Reparth & McGregor are preparing plans for new Ajo leaching plant.

OLD DOMINION (Globe)—Since shutdown, caused by flooded mine resulting in loss of two months' production, output resumed has expanded to rate of nearly 3,000,000 lb. copper per month. In petition by A. S. Bigelow for reopening Old Dominion litigation, arguments have been finished and finding by master is expected soon.

Mohave County

GILT EDGE (Oatman)—Charles Oster, in interest of New York capitalists, has taken over Gilt Edge group.

GOLCONDA (Union Basin)—Amster interests have taken up their option on majority stock in Union Basin Mining Co.

WALKOVER (Hackberry)—A. F. Frazer has taken over Walkover mine about four miles from railway west of Copper Giant.

LAZY BOY (Oatman)—Lazy Boy group has been taken over by Los Angeles people represented by H. K. Wheeler, of Cripple Creek.

MOONLIGHT (Oatman)—Fred Crosley and J. O. A. Carper, of Cripple Creek, have taken over Straight, Moonlight, Cash Entry, Sunlight and Hardy groups, adjoining United Eastern property.

ARIZONA SOUTHWESTERN COPPER (Kingman)—Will sink shaft from 200 to 500 level. Big body of lead ore was opened up by crosscuts run from 200 level. Company said to be in strong financial condition. J. H. Hoffman is general manager.

Pinal County

KELVIN-SULTANA (Kelvin)—Two cars of concentrates shipped to Hayden smeltery. Leasers shipped car of carbonate ore.

Santa Cruz County

FLUX (Patagonia)—Mill equipment beginning to arrive. Arranged to ship ore over new tram while mill is being built.

Yavapai County

ARIZONA POWER CO. has been granted permission to issue $340,000 in bonds for the purpose of adding to its power plant on Fossil Creek. Company is supplying several mines in Jerome camp and smeltery at Clarkdale as well as power and lights for the Town of Prescott.

MARY E. (Morristown)—Additional men have been put on to continue shaft from which shipping-grade gold ore is being taken.

GOLDEN STATE (Wickenburg)—At recent stockholders' meeting it was voted to resume work on property of company 11 miles north of Wickenburg.

Yuma County

ARICA (Ehrenburg)—Property is being equipped with mill and some additional mining machinery. Shaft to be sunk to 1000-ft. level.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Mine is paying expenses, with surplus in treasury, but continuation of dividends at present is not advisable.

ZEILE (Jackson)—Action brought in Superior Court to quiet title to Yellow Jacket mining claim. Company avers that unrecorded deed was destroyed in San Francisco fire, a source of destruction quite frequently mentioned in the courts.

Butte County

OROVILLE DREDGING (Oroville)—Returns from London dated May 7; for four-week period ended Mar. 25, cubic yards dredged, 169,563; gross return, $18,228.

Fresno County

VALLEY PIPE LINE (Coalinga)—First four sections, comprising about 47 miles of oil pipe-line for Valley Pipe Line Co., subsidiary of Shell Royal Dutch Co., designed and built by Sanderson & Porter, was placed in successful operation on May 15. This line is 170 miles long, extends from Coalinga oil fields to tidewater terminal near Martinez in San Francisco Bay, and will have carrying capacity of 25,000 bbl. per day. Storage capacity at pumping stations now in operation on this first section of line amounts to 225,000 bbl., which is thus made immediately available for storage of surplus production.

Nevada County

BRUNSWICK CONS. (Grass Valley)—Will soon begin erection of cyanide plant.

Shasta County

FIELD PROCESS CO. (Redding)—Will enlarge plant at Redding and engage in manufacture of commercial products from its waste smelting smoke. About $30,000 will be expended.

Sierra County

RED JACKET & GOOD HOPE (Pike City)—Has been bonded by Thomas Rose to H. J. Ellert of Grass Valley, who has begun extensive development work.

GOLD BLUFF-OXFORD (Downieville)—Stamp mill running steadily on Gold Bluff ore. More workmen have been added and tramway is being built to transport rich ore uncovered on Oxford to mill. Both properties are under bond to Grant Snyder and associates of Salt Lake.

TELEGRAPH (Downieville)—Gravel claims of Telegraph company of Chicago have been bonded to Hunt & Bell. Development of this property was under management of late Hon. J. W. Finney, during which rich quartz ledge was struck. Operations were then directed to quartz development, but serious damage to machinery and buildings by fire and snowslides compelled suspension of active work. Gravel has yielded well and there still remains a large extent of virgin channel which will be opened by Hunt & Bell.

COLORADO

Boulder County

BOULDER COUNTY METAL MINERS' ASSOCIATION states that the 1915 metal production of the county will be fully $1,500,000 in gold, silver, tungsten and copper. This is substantial increase over any recent year.

BLACK CLOUD MILL (Salina)—On custom basis, is treating concentrating ores from various parts of county.

LIVINGSTON (Sugar Loaf)—Electric-driven centrifugal pump placed in No. 2 shaft and development is being pushed on several levels.

EUREKA (Boulder)—Up-to-Date Mining Co. is stocking high-grade lead-silver-gold ore taken from large shoot opened by 1100-ft. crosscut adit at depth of 380 ft. Lead ore is novelty in this county.

Clear Creek County

BIG FIVE (Idaho Springs)—Leasers have developed strong oreshoot in Lake vein and have, for several weeks, been shipping several carloads per week of ore averaging about $40 per ton in gold and silver. Other ores coming from this adit are treated in Hudson mill, which is running at capacity under management of Arthur Roller.

Gilpin County

THIS COUNTY'S CUSTOM-MILLING NEEDS are indicated by congestion of few mills now running and fact that every car on Gilpin County Tramway (local narrow-gage ore-handling railway) is loaded. At Iron City mill there are 125 loads of one cord each continually awaiting unloading.

Lake County

GARBUTT (Leadville)—Despite breakdowns in hoist and compressor, mine maintains output of 50 tons per day, averaging $15 per ton. During repairs to compressor, air is piped from Little Jonny plant. Plans being made to build concentration plant at mine.

Summit County

ORO GRANDE PLACER (Dillon)—Col. L. Kingsbury, of Denver, well-known placer operator, has secured option to this 625-acre tract along Blue River and is organizing dredging company. This property has been favorite area for experiments with hydraulic lifts, steam shovels and portable sluice outfits; but it is obviously dredging tract.

Teller County

PROPER (Cripple Creek)—Leasers are shipping from a 10-ft. shoot of $30 ore on 220 level.

VICTOR (Independence)—Schultz et al., leasing 800 level, have developed 100 ft. along 4-ft. body, from which 1.5- to 2-oz. ore is shipped in good amount.

AJAX (Victor)—Supt. A. E. Colburn, Jr., announces that leases will be granted on blocks of ground down to 1100 level and applications are being received.

PORTLAND (Victor)—Leaser L. D. Creclius has shipped eight carloads from vein 26 ft. wide on 220 level. Average settlement value was $18 per ton.

MORNING GLORY (Anaconda)—Hoisting plant will be installed by leasers who hold two blocks of ground that will be worked from this shaft in Doctor-Jack Pot territory.

ISABELLA (Victor)—New ore-houses are to be erected at Isabella and Empire State shafts. New large compressor has beeen purchased to permit greater development. Forty-five sets of leasers.

ECONOMIC (Victor)—W. F. Vansant, general manager of Copeland Ore Sampling Co., has completed tramway and a 100-ton ore-house for handling dump stuff to railroad. Will ship 80 to 100 tons daily to his sampler and then to Golden Cycle cyanide mill, Colorado City.

JERRY JOHNSON (Cripple Creek)—Cripple Creek Deep Leasing Co. will develop new ground in this old mine. C. A. Chapman ships small lots of $15 washings from dump. Frank Caley has completed new 100-ton cyanide mill and expects to start it running in two weeks.

EL PASO (Cripple Creek)—After more than year of unprofitable operations due to destruction by fire of main shaft and equipment and to certain administrative deals, company is getting back into dividend shape. Change in management and policy resulted in mine operating at slight profit during April, with indications of substantial betterment for May.

IDAHO

Shoshone County

INTERSTATE-CALLAHAN (Sunset) — Shipments aggregate 6000 tons of zinc concentrates per month and it is believed that they will be materially increased since new unit to mill and aërial tramway from mill to railroad are in operation. Present production could be continued for 3 years without any further development of ore reserves.

SILVER CABLE (Mullan)—Rich ore recently struck was in raise from lower tunnel. Raise now up 110 ft. and has 200 ft. more to go to connect with intermediate level 100 ft. below No. 1 tunnel. Crosscut from raise at the 100-ft. point opened 4 ft. of high-grade zinc ore and 16 ft. of milling ore. Commissioners of Mineral County constructing road from lower tunnel to railroad, employing convict labor. Shipments will be begun in about 60 days.

REINDEER-QUEEN (Mullan)—As result of consolidation of these two companies long Reindeer tunnel has been driven into old Copper Queen ground and last 30 ft. has been in high-grade milling ore containing considerable first-class ore. Development work has been suspended for a few days, to await completion of ore bins in which first-class ore will be dumped and shipped to smelter. As soon as sufficient ore has been developed work will be started on erection of concentrator.

SNOWSTORM (Mullan)—About 30 men are doing development work on lower level. Company has secured a year's extension on pool of Missoula Copper stock. Less than 10% of pool was released. First payment due in August. Snowstorm has spent $40,000 in development of Missoula ground up to present time. Action started in District Court by Pandora company to secure survey of No. 3 and No. 4 levels of Snowstorm. Claiming that defendants are working in their ground on those levels.

MICHIGAN

Copper

NEW ARCADIAN (Houghton)—Showing on 9th level continues to be as good as of any rock taken out. Vein continues 16 ft. in width and is well mineralized clear across. Sinking is now under way. Michigan smeltery is handling mineral recently stamped at Franklin mill.

CALUMET & HECLA (Calumet)—Two additional furnaces will start operation at C. & H. smelting plant at Hubbell this week, owing to additional mineral coming from old mine and from different subsidiaries. Erection of two new traveling cranes is about completed. One is a 40-ft. span and operates inside smeltery. The other 50-ft. span conveys copper from the main smeltery to electrolytic plant, eliminating small cars.

NONESUCH (Otonagon)—Adjoining White Pine is to be opened soon. Property is owned and controlled by Milwaukee people who are not otherwise interested in copper mines of this district. At one time Calumet & Hecla had option on property and did some exploring, but option was not renewed when it expired. Lumber and supplies already have been hauled on to location. It is general belief that proximity of White Pine success has made it possible for Nonesuch interest to raise funds for further work.

WHITE PINE (Ontonagon)—This C. & H. subsidiary is operating all new machinery two shifts. No. 3 stockpile is almost exhausted and work is confined to stockpile at No. 4 and underground. Underground force is being increased daily. Mill is turning out from 15 to 20 tons of mineral daily. Chicago Bridge Co. has men at location erecting water tank for fire protection. Will have capacity of 30,000 gal. Height to top of tank is 97 ft. There are 400 bbl., about 700,000 lb. of mineral, at mill waiting for shipment to the smeltery. If weather continues warm and dry for a period of two weeks it will be possible to convey mineral over rough roads to water front where it can be scowed to Hubbell.

MINNESOTA

Cuyuna Range

MAHNOMEN (Ironton)—Contractors have begun stripping operations on company's orebody of 4,000,000 tons, with large additional tonnage of manganiferous ore, west of Pennington pit. Northern Pacific Ry. will handle traffic. One million yards of overburden will be removed this season.

IRON MOUNTAIN (Iron Mountain)—Entire headframe of shaft tipped over on May 14, due to cars jumping track while switching. To add to difficulty, pumps ceased operating, permitting mine to fill with water. Two men injured, but not fatally. Operation of this manganiferous deposit has been in hard luck and company is not financially strong.

Mesabi Range

LA RUE (Nashwauk)—This operation along with others in district will hereafter get electric current from Great Northern Power Co., which has just completed transmission line to western Mesabi Range. New La Rue washing plant will also be operated by electricity.

ON MESABI RANGE independent producers suspended shipments until June 1, when the lower freight rate became effective. At Keewatin and Nashwauk entire list of shippers, except Bennett, suspended. Shipments from Steel Corporation properties over range continue at normal rate.

MONTANA

Fergus County

BARNES-KING DEVELOPMENT (Kendall) — President Goodale says the only basis for rumor of possible litigation with the Kendall Mining Co. over ore deposits of North Moccasin and Kendall mines is fact that he has been in correspondence with Kendall people relative to an agreement as to boundary of orebody to which each company is entitled, and there is no possibility of any litigation. Only a small portion of the orebody is involved in question of establishing a boundary agreement. North Moccasin's main orebody is in another portion of the ground.

Jefferson County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Tunnel has cut another cross-vein at distance of 1808 ft. from portal. The vein contains copper and silver, lying in layers with quartz. It is regarded as most important discovery yet made in tunnel.

Silver Bow County

ANACONDA (Butte)—Will soon resume work replacing more steam hoists with compressed air hoists, preparations having been made to make change at Neversweat and Moonlight mines next.

BUTTE & SUPERIOR (Butte)—Highest value of concentrates recovered by oil flotation process were those reported for April, value being $62.26 per ton, against $47.38 per ton in March and $48.64 in February.

NEVADA

Esmeralda County

C. O. D. CONSOLIDATED (Goldfield)—Reported negotiations under way to grant working option and control to Tonopah Belmont.

FLORENCE-GOLDFIELD (Goldfield)—Six-foot vein assaying $45 opened on 250 level. Shipments at intervals pay all operating expenses. Drifting on same vein on 350 level under way.

GOLDFIELD CONSOLIDATED (Goldfield)—Lidgerwood cableway for transportation of old tailings from pond to mill completed; installation cost $90,000. Stated profit of $1,500,000 will be made from this source.

Humboldt County

SHIPMENTS FROM WILLARD being made. Honey Bee Co. and Oddie Lease, on same company's ground, hauling ore to railroad. On Finlander, ore bins built so ore can be loaded into wagons without sacking. Ore assaying $18 to $40 gold per ton being broken on this ground. Fifteen sets of leasers working in district.

NEVADA PACKARD (Rochester)—Contract for erection of 100-ton mill awarded to California Extraction Co., San Francisco. Process will be amalgamation and cyanidation. Tests gave 96% extraction on ores assaying 41 to 62c. gold and 20 to 37 oz. silver. Mill construction to begin soon. Water lines being laid.

ROCHESTER MINES (Rochester)—Has voted to acquire the Rochester Weaver Mining Co. by purchase. Will increase capitalization from 1,250,000 shares to 2,250,000 shares, of which Weaver will receive 684,000. Consolidation effected because portions of Rochester Mines veins extend in depth into Weaver property and litigation will thus be avoided. Four claims of the Weaver can be economically developed by deep tunnel on Rochester.

Nye County

TONOPAH ORE PRODUCTION for week ended May 22 was 10,548 tons valued at $215,824 compared to 10,617 tons

last week. Producers were: Tonopah Belmont, 3709; Tonopah Mining, 2700; Tonopah Extension, 1725; West End, 760; Jim Butler, 1150; Tonopah Merger, 225; Halifax, 104; and miscellaneous leasers 175 tons.

TONOPAH EXTENSION (Tonopah)—Has agreed to purchase Tonopah Merger and Tonopah Victor mines which immediately adjoin Extension property. Will pay all debts of two companies and exchange 7 shares Merger stock for one of Extension and 8½ of Victor for one of Extension.

CASH BOY MINING VS. TONOPAH EXTENSION (Tonopah)—Suit filed in Federal Court, Carson City, to determine end lines and to quiet title to lode or vein now being worked by latter company. Court also asked to define apex rights of companies. No damages asked and no restraining order prayed for.

Ormsby County

GOLD-COPPER STRIKE WEST OF CARSON CITY made recently. Rich float found in this district years ago, but ledge deeply covered by débris. New tunnel site located and work started.

Storey County

BUTTERS CYANIDE PLANT (Virginia City)—This plant in Six-Mile Cañon, 1½ miles east of Virginia City, will resume operations soon. Plant has been shut down for several months.

OPHIR (Virginia)—North drift in Central tunnel advanced 13 ft. following quartz vein 6 ft. wide. Face samples average $12 per ton. Face now 82 ft. from main west crosscut. Last 40 ft. in virgin ground. Repaired old east crosscut. Andes crosscut advanced 15 ft. Face in low-grade quartz. Saved 297 cars of ore from stopes on 56-ft. level and east ledge and from development work. Milled 245 tons of ore.

NEW MEXICO

Grant County

AN ADDITIONAL CATERPILLAR TRACTOR, manufactured by Holt Mfg. Co., of Stockton, Calif., has been placed on 85 Mine-Lordsburg ore haul by Rowan & Downey. Two "caterpillars" operating two shifts are hauling 400 tons daily.

U. S. COPPER (Hanover)—Philadelphia mine being unwatered and preparations being made for resumption of operations. Hodge & Atteberry in charge of work.

WALDO (Lordsburg)—Concentrator being erected at Waldo mine by Los Angeles capitalists. Stebbins dry concentrator being used. Will treat carbonate lead ore now on dump. Flow: Ore bins to rotary jaw crusher to pebble mill to screen to fine ore bin. Over Stebbins table. Tailings to bins, for reconcentration. Framework of mill now being built. Machinery on ground for installation. In experimental plant 65% concentrate secured.

SOUTH DAKOTA

Lawrence County

RAINBOW (Maitland)—Burns, Sanford & Von Woehrmann, leasers of this property, are prosecuting work on body of milling ore which as extracted is piled on dump.

WELLS FARGO (Maitland)—Leasers are regularly shipping mill ore to Golden Reward plant, Deadwood, and occasional carloads of $30 to $40 ore to smelteries.

NORTH HOMESTAKE (Maitland)—Further development on 600 level will be inaugurated soon, according to statement of A. Maitland, of Negaunee, Mich., president and principal owner. Property is believed to contain northerly extension of Homestake vein system.

MINNESOTA (Maitland)—Development is to be instituted on vertical free-milling vein outcropping on west end of property. Adit will be continued along strike of vein, with occasional crosscuts from wall to wall. Nearly 18 ft. of ore is now in sight, but is only meagerly developed.

McHUGH PROPERTIES (Deadwood)—William Flynn and associates, of Pittsburgh, have been given options on McHugh and Gillmore properties, situated between Deadwood and Lead, and it is expected development on broad lines will be inaugurated. Preliminary examination was satisfactory.

ECHO (Maitland)—Since sinking was discontinued May 1 on account of trouble with water, 10x12 single-stage compressor, driven by 30-hp. motor, has been installed, and No. 5 Cameron sinker driven by compressed air will be used. Flow of water not great, but larger than could successfully be handled by bailing. Extra hoisting cable has been spliced on and all preparations made to quickly sink to 300 ft. depth when work is resumed.

ORO HONDO (Deadwood)—Sinking has been resumed below 1500 level, to which point auxiliary hoist has been moved. Lateral work is also in progress on that level. In deepening the shaft two compartments are bulkheaded and sinking prosecuted through third compartment; from 1500 level to surface, rock is hoisted in skips in two compartments. Shaft is vertical; self-dumping skips are used. But little water has been handled past few months since surrounding rock was drained by continuous work. After shaft was unwatered, much pumping was necessary for five or six months.

UTAH

Juab County

TINTIC ORE SHIPMENTS for week ended May 21 were 125 cars, estimated at 6250 tons, valued at $155,000, compared with 147 cars last week. Decrease accounted for by stormy weather, which delayed and prevented ore hauling and dump work.

TINTIC STANDARD (Eureka)—Preparations are being made for resumption of work at this property, which has been idle for several weeks.

SCOTIA (Tintic Junction)—Cost of hauling ore from this property to railroad is being investigated. Auto trucks will probably be used. Several cars of lead-silver ore have been accumulated.

LOWER MAMMOTH (Mammoth)—On 700 and 1000 levels work is being done on company account; in other parts of mine leasers are working. Some zinc ore carrying over 30% is being shipped.

MAY DAY (Eureka)—Griggs-Carter-Castleton cyanide mill at this property—closed down since fall—is again in operation. Although zinc market is unsettled, May Day company is continuing to mine zinc ore running over 30%.

RIDGE & VALLEY (Eureka)—Work resumed here June 1. Thus far only small part of property has been developed, producing 12,679 tons of ore of gross value of about $359,000. Shares amounting to 250,000 have been placed in treasury to be used for development; of these, first allotment of 50,000 has been taken by present stockholders. Property is on the Centennial-Eureka, Eureka Hill, Bullion Beck and Gemini ore zone, through which latter property work will be carried on.

Summit County

PARK CITY ORE SHIPMENTS for week ended May 22 amounted to 1771 tons, estimated at $70,000, compared with 1666 tons last week. There were five producers.

ONTARIO (Park City)—Mine is again being worked on company account, and it is stated increase will be made in working force. Operations are being carried on on 600 level.

NEW QUINCY (Park City)—Stock of new company being received share for share in exchange for old Thompson-Quincy stock. Work will be undertaken in unprospected ground north of Daly-West, operations to be carried on from Daly-West 1260 level.

SILVER KING COALITION (Park City)—At annual meeting held May 17, officers of preceding year reëlected. David Keith is president and Thomas Kearns vice-president. Conditions at mine stated to be excellent and large tonnage blocked out so that production can be increased when market warrants. Flotation plant to treat sulphide ore from below the Alliance tunnel will be installed.

VIRGINIA

Shenandoah County

POWELL'S FORT (Woodstock)—H. P. Binswanger, of New York City, is developing this manganese property in the Shenandoah Valley, 11 miles from Woodstock. Work is under supervision of J. Carson Adkerson, of Lynchburg, Va., who has been connected with Piedmont Manganese Corporation of Concord, Va., and with its successor, Oxford Mining & Manganese Corporation. Powell's Fort mine produced pyrolusite ore for many years.

WASHINGTON

Stevens County

UNITED COPPER (Chewelah)—First unit of 20 stamps of new plant will start early in June. In conjunction with old plant will give capacity of 200 tons per day. Next month 30 more stamps will be added and additional flotation equipment.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTING (Trail)—Total ore treated in current year to date 144,728 tons. Greater part comes from Rossland.

Nova Scotia

DOMINION STEEL (Sydney)—New benzol and toluol plant is in operation, and considerable quantity of benzol has already been made. Toluol is now being produced. It is understood nitration of toluol is to be undertaken by Canadian Explosives Co., at its Ste. Anne plant.

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for the month of April, were from Cobalt proper: Beaver, 68; Cobalt Comet, 63; Coniagas, 43; Crown Reserve, 99; Kerr Lake, 57; La Rose, 145; McKinley Darragh, 155; Mining Corporation of Canada, Ltd., 404; Cobalt Lake, 100.97; Townsite City, 303.39; Peterson Lake (Seneca Superior Ore), 72.97; Temiskaming, 43.90; from South Porcupine, Dome Lake (gold), 61; from Porquois Junction, Alexo Mine (nickel), 665 tons. Total 1880 tons.

CONIAGAS (Cobalt)—Discovery of 500-oz. ore has been made on 300 level drive from new shaft. Vein is 4 in. wide.

TOUGH OAKES (Kirkland Lake)—A gold bar weighing 835 oz., valued at about $14,000, the result of the cleanup at new mill, has been shipped.

CHAMBERS-FERLAND (Cobalt)—No. 1 shaft house was destroyed by fire on the night of May 15, entailing loss of $7000 partly covered by insurance.

IMPERIAL (Porcupine)—Underground development resumed May 19. Ore stated to average between $9 and $10 per ton being taken from 100-ft. level.

HOLLINGER (Timmins)—Usual four-weekly statement for period ended Apr. 22 shows gross profits of $141,457 from treatment of 22,952 tons of ore, average value $10.40 per ton, compared with $11.35 for last period. Working costs were reduced to $3.71 per ton, lowest reported. Mill also treated 4231 tons for Acme.

DOME MINES (South Porcupine))—For last six months mill has averaged between 20,000 and 23,000 tons per month, with saving of 90% to 91%. Next month is expected to get up to 27,000 tons, and in 30 days thereafter to get up to full capacity, between 28,000 and 30,000 tons per month. The president says: "Plan is to double capacity of mill within same mill building, without loss of time, and this completed to build mill of much larger capacity, depending entirely on tonnage developed, with money now being contributed for new stock."

The Market Report

Metal Markets

NEW YORK—June 2

Copper has been a little stronger, but no new buying movement of force has yet developed. The special features of the last week have been a spectacular rise in lead and a continuance of the crazy advance in spelter.

Copper, Tin, Lead and Zinc

Copper—The last was another week of dullness, but there was more inquiry and also there was more business done in outside markets; that is, markets other than New York. At the beginning of the week, sales were made in this market at 18⅝c., regular terms, then at 18¾c. Sellers who then advanced their price to 18⅞c. failed to realize it, such demand as there was being met by cheaper sellers, copper being still available at 18¾c., regular terms, at the close, while it was offered for export at 18½c., cash, New York. Certain large producers maintained their previous asking price of 19c., regular terms, right through the week, and realized the equivalent of that in interior and noncompetitive markets. A renewed buying demand of large proportions is expected to develop, but the news that it had started, communicated through Wall Street channels on June 2, was premature.

Copper Sheets base price 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire, 20@20½c. per lb. at mill, carload lots.

Tin—A moderate business was done with but little fluctuation in price during the week. Deliveries were large.

Nigerian tin production in April was 368 tons concentrates; for the four months ended Apr. 30 it was 1482 tons.

Imports of tin ore into Great Britain in April were: United States, 3 tons; France, 13; Portugal, 16; British India, 33; Spain, 49; South Africa, 242; Nigeria, 658; Bolivia, 3075; total, 4089 long tons, equivalent to about 2450 tons of tin.

Exports of tin from the Straits five months ended May 31 are estimated at 27,785 long tons in 1914 and 26,549 in 1915; a decrease of 1236 tons this year.

Tin output of the Federated Malay States four months ended Apr. 30 was 16,464 tons in 1914, and 14,352 in 1915; a decrease of 2112 tons this year.

Lead—Some large sales at about 4⅜c., New York, just before the close of business on May 26 foreshadowed the advance to 4.40c. that was made by the A. S. & R. Co. on May 28. That company then made advances on each day following, up to June 2. A rather large business was done at the advance. Respecting the meaning of this spectacular advance in lead there are differences of opinion. There has been large buying by ammunition manufacturers and also of lead that is supposed to be destined for export. On the other hand, production has not yet regained the rate of a year ago, and it was desired to stimulate production in view of a larger demand expected later in the year. Of course no such advance as ½c. per lb. in a week would have been necessary to accomplish that. It is possible that the advance having been started for this purpose some nervous buyers foresaw a repetition of the antics in spelter and deemed it wise to be forehanded and thus put up the market on themselves. It is possible also that there may have been buying for speculative account. At all events there were large transactions during the week, with buying a little more quiet on Wednesday than it had been previously.

The substitution of terne plate for galvanized sheets is resulting in an increased demand for lead, but not enough to be an important factor in the recent upward movement in lead.

Spelter—The last week was even more crazy than the crazy week immediately preceding, although the aggregate of transactions was not quite so large. However, we had reports of a very large tonnage. Prices were at sixes and sevens, differences of cents per pound being recorded in the same office on the same day. Some buyers appeared to do no shopping, but paid what was demanded of them. With such conditions existing it is impossible to quote the market with accuracy. A large volume of business was done at an average of about 21¾c. for the week. On June 2 one sale of spot spelter—a round lot—was made at 26½c., and there may have been sales at even higher than that.

The buying of last week was chiefly by brass makers, but there was at least one purchase by a galvanizer. It was a noteworthy feature that among the sales of last week the relatively early deliveries—June-July, July-August, etc.—were more in evidence than in the previous week. American contracts for delivery of spelter in Europe were repurchased on a considerable scale.

A highly important question at the present time is the extent to which producers have contracted their output for the last half of 1915. An estimate by one authority in the trade is that about 75% of the expected production in the third quarter and 30% of that for the fourth quarter have been sold.

DAILY PRICES OF METALS IN NEW YORK

May June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
27	4.7831	49⅝	18.40 @18.60	37¼	4.40	4.30 @4.35	19 @21
28	4.7850	49½	18.50 @18.60	37½	4.50	4.40 @4.45	20 @22
29	4.7850	49½	18.50 @18.60	37½	4.75	4.62½ @4.67½	20 @22
31	.....	...	.....	..	....	.....	.....
1	4.7850	49⅝	18.50 @18.60	37¾	4.90	4.82½ @4.87½	21½ @23½
2	4.7838	49½	18.50 @18.60	37¾	4.90	4.82½ @4.87½	23 @25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

May-June	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.				
		£ per Ton	Cts. per Lb.					£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
27	23½	77¼	16.78	78¼	....	162	161½	20 7/16	4.44	77½	16.84
28	23 7/16	78¾	17.11	79⅝	....	163¼	163	20¼	4.40	80	17.38
29	23 5/16	.....	.....	.....	....	.....	....	.....	.....	....	...
31	23 5/16	79⅛	17.19	80⅛	....	162½	162½	20 1/16	4.55	84	18.25
1	23⅜	78⅝	17.14	79¾	....	160½	160	21½	4.67	92½	20.10
2	23 5/16	79¼	17.22	80	....	160	159½	*	....	95	20.64

*Not received.

The above table gives the closing quotations on London Metal Exchange All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—June 2

Aluminum continues in demand and prices are firm, 26@27c. per lb. being quoted for No. 1 ingots, New York. The chief producer here is holding back on prices.—**Antimony** is quiet and rather nominal. Business here is restricted to actual present demands. Ordinary brands are 34@36c. per lb and Cookson's is held at 45@47c. No quotations are made on futures.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is firm, and supplies not large. In New York no quotations are made today on large lots. Smaller orders are $75@80 per flask of 75 lb. San Francisco price is telegraphed at $65@67.50 nominal, but dealers hold for as high as $80. London price is £11 15s. per flask, with £11 12s. 6d. named from second hands.

Gold, Silver and Platinum

Gold imports continue, $7,500,000 having been received from Ottawa last week and $2,000,000 from France. Some more gold from Japan is also reported on the way.

Iridium is rather scarce, as it has been for some time. It is difficult to quote any general prices as transactions are generally on private terms and for small quantities.

Platinum is quiet with no large business reported. The market continues dull in a general way. Dealers ask $37@39 per oz. for refined platinum, and $41@44 for hard metal, according to grade.

Silver—The market continues quiet with a moderate demand and small fluctuations. Latest London advices report that competition for supplies is rather slight at present, but at the same time there is a disposition to consider possble advance as not an unreasonable expectation.

Gold and Silver Movement in the United States four months ended Apr. 30 is reported by the Department of Commerce as follows:

	Gold		Silver	
	1914	1915	1914	1915
Exports	$19,032,269	$3,482,985	$16,026,149	$16,139,271
Imports	24,953,859	61,446,385	9,013,052	9,767,051
Excess	I.$5,921,590	I. $57,963,400	E. $7,013,052	E. $6,372,220

Gold imports in April were $16,203,028; exports, $813,706; excess of imports, $15,389,322. Exports of merchandise for the four months in 1915 were valued at $1,158,767,333; imports, $565,829,830,565; excess of imports, $592,937,768. Adding the gold and silver gives $541,346,588 as the net export balance.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 29

The competitive or open market base price paid for 60% zinc ore the past week advanced to $75 per ton. The base price paid for 80% lead ore was $55 per ton. The Edgar Zinc Co., the Picher Lead Co., and the Lanyon Zinc & Acid Co., have entered this field as buyers of zinc ore.

SHIPMENTS, WEEK ENDED MAY 29

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,263,260	196,450	1,350,140
Year	75,468,120	2,915,190	10,269,590

Shipped during week to separating plants, 4,625,940 lb. zinc ore.

JOPLIN, MO.—May 29

Blende, high price $88; assay base per ton of 60% zinc, premium ore $85; medium grades $83@81; lower grades down to $70. Calamine base, per ton of 40% zinc, $61@55; average, all grades of zinc, $75.81 per ton. Lead, high price $54.50; base $51@52 per ton of 80% metal content; average, all grades of lead, $50.13 per ton.

SHIPMENTS WEEK ENDED MAY 29

	Blende	Calamine	Lead	Values
Totals this week	13,498,600	1,690,540	1,535,720	$614,120
Totals 5 months	237,794,030	21,544,860	35,075,130	8,713,810

Blende value, the week, $532,290; 5 months, $7,448,080.
Calamine value, the week, $43,350; 5 months, $408,160.
Lead value, the week, $38,480; 5 months, $857,570.

Premium ore was advanced $10 per ton, and a number of sellers declined this price. This week's purchases clean up the last bin of surplus ore in the district, except what is owned by the Granby Mining & Smelting Co. at Granby. All other large bins are sold and much of it delivered. Undelivered stock will aggregate tonight about 7000 tons, the bulk of which is sold.

Iron Trade Review

NEW YORK—June 2

The position of the iron and steel trades remains about the same. Domestic business is improving slowly and the foreign trade continues to develop into rather large proportions.

The foreign trade has been subdivided to such an extent that it is not easy to trace it; perhaps, also, the contractors are not anxious to make their orders too public. It is calling for large quantities of material from the mills, at any rate.

While structural steel is still rather quiet there is a good demand for smaller building material. A special feature is the demand for hard bars for reinforced concrete work. Railroad orders also are coming in more freely than they have been for some time.

The pig iron market is improving slowly, and foundry iron seems to be more in demand. More iron is also being called for on contract deliveries.

PITTSBURGH—June 1

There has been a further improvement in the steel trade, both in actual shipping orders booked and in the outlook. Steel trade sentiment is now hopeful in the extreme and it is regarded as practically certain that before long the mills will be operating substantially at capacity.

Nearly all the large steel interests booked larger tonnages in May than in April, in actual shipping orders. In contracting not so much was done, partly because May was the middle month in the quarter and partly because the mills are rather reserved about incurring market obligations. A fair tonnage of steel bars for the implement trade was booked, for shipment over the second half of the year. The Steel Corporation's unfilled obligations promise to show a slight increase during May, after two months of small decreases.

Galvanized steel products have advanced sharply, on account of the high price and scarcity of spelter. Effective today, the American Sheet & Tin Plate Co., almost the only seller of galvanized sheets, advanced to 4.25c. for 28-gage, making a total advance since last December of no less than $32 a ton, due entirely to the spelter situation since black sheets are unchanged at 1.80c.

The car shops that participated in the Pennsylvania awards of 14,000 freight cars are covering the steel and will shortly furnish specifications for rolling. The Pennsylvania's orders for 138,000 tons of rails are likely to be placed within a week and rolling should begin almost at once.

The Pittsburgh and Valley steel mills are operating at 80 to 90% of the capacity, and the average of the whole country has risen above 75%, with prospects of 80 to 85% by the end of the month.

Pig Iron—The pig iron market continues surprisingly dull in view of the further improvement in steel. Shipments, however, are slightly better and more activity in the near future is confidently expected. W. P. Snyder & Co. announce average prices in May, based on actual sales in 1000-ton lots and over, of $13.659, Valley, for bessemer, and $12.65, Valley, for basic. We quote: Bessemer, $13.75; basic, $12.50@12.65; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Chemicals

NEW YORK—June 2

The general markets show some signs of improvement, though business in most lines is only fairly active.

Arsenic—Demand continues on a moderate scale only. The market is rather steady. Quotations continue about $4 per 100 lb. for both spot and futures.

Copper Sulphate—On a fair business prices are unchanged. Current quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Business shows little change. Demand is fair. Quotations are 2.30c. per lb. for spot and all positions this year.

Potash Salts—Imports of potash salts into the United States for the four months ended Apr. 30 are reported by the Department of Commerce as follows:

	1914	1915	Changes
Potash salts, lb.	13,966,683	12,334,868	D. 1,631,815
Fertilizer salts, tons	396,982	80,925	D. 316,057

Fertilizer salts include kainit, sulphate and muriate of potash and manure salts or crude salts.

Pyrites—Imports at Baltimore for the week include 5203 tons of pyrites from Huelva, Spain.

Assessments

Company	Delinqe	Sale	Amt.
Argenta, Ida.	May 10	June 10	$0.001
Belcher, Nev., (post.)	June 14	July 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Blue Star, Ida.	June 19	July 10	0.01
Cash Boy, Nev.	May 17	June 17	0.01
Cedar Creek, Ida.	May 5	June 5	0.005
Contact Copper, Mich.	May 15	.....	0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Duluth, Ida.	June 5	July 8	0.001
Emerald, Utah (three instal.)	.....	June 9	0.01
Glen Metal, Ida.	May 31	July 1	0.002
Hancock Cons., Mich.	Sept. 1	.....	1.00
Hancock Cons., Mich.	Jan. 3	.....	1.00
Houghton, Mich.	May 25	.....	1.00
Idaho-Nevada, Ida.	May 10	June 5	0.002
Laclede, Ida.	May 24	June 14	0.003
Majestic-Idol, Nev.	Dec. 15	July 20	0.005
Mayflower, Ida.	June 15	July 17	0.005
Monarch Pitts., Nev.	June 14	July 14	0.01
Moonlight, Ida.	.....	June 5	0.005
Mullan, Ida., (post.)	.....	June 24	0.002
Nevada-Douglas, Nev.	Apr. 24	June 10	0.10
New Arcadian, Mich.	June 1	.....	0.50
New Arcadian, Mich.	Dec. 1	.....	0.50
North Bunker Hill, Ida.	June 12	July 17	0.002
North Lake, Mich.	.....	June 15	1.00
O. K. Silver, Utah.	May 3	June 5	0.0025
Ophir, Nev.	June 4	June 25	0.05
Overman, Nev.	May 19	June 8	0.05
Rainbow, Ida.	July 7	Aug. 7	0.002
Raymond-Illinois, Utah	May 24	June 9	0.005
Raven, Ida.	May 15	June 14	0.0006
Royal, Ida.	June 1	July 6	0.0015
Samson, Ida (post.)	.....	June 3	0.002
Selma, Utah.	May 29	June 16	0.005
Silver Moon, Ida.	May 18	June 18	0.005
Silver Mountain, Ida.	May 15	June 15	0.002
Silver Pick, Nev.	June 5	July 12	0.01
Treasure, Calif.	.....	.....	0.05
Union, Nev.	June 18	July 9	0.05
United Tintic, Utah.	May 25	June 15	0.005
Utah United, Utah.	May 20	June 10	0.01
Virginia, Ida., (post.)	.....	June 29	0.02
Wisconsin, Ida.	May 15	June 15	0.003
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

Stock Quotations

Among sales at auction we note: In Boston, 500 Potosi Mine pfg., $25 lot; in Philadelphia, 500 Buck Mountain (Nev.) Gold, $2 lot. No mining shares at auction in New York.

COLO. SPRINGS June 1

Name of Comp.	Bid.
Acacia.	‡.04¾
Cripple Cr'k Con.	‡.01¼
C. K. & N.	‡.03½
Doctor Jack Pot.	.10½
Elkton Con.	.40
El Paso.	1.05
Findlay.	.04¾
Gold Dollar.	.02
Gold Sovereign.	.05
Golden Cycle.	1.73
Isabella.	.18¾
Jack Pot.	.06½
Jennie Sample.	‡.02
Jerry Johnson.	.04
Lexington.	‡.008
Mary McKinney.	.35
Pharmacist.	‡.01¾
Portland.	1.47
Raven B. H.	‡.03
Vindicator.	1.58

SALT LAKE May 29

Name of Comp.	Bid.
Beck Tunnel.	.04½
Black Jack.	.06½
Colorado Mining.	.10
Crown Point.	.01½
Daly-Judge.	5.30
Gold Chain.	.10
Grand Central.	.55
Iron Blossom.	.70
Little Bell.	.14
Lower Mammoth.	‡.04
Mason Valley.	‡2.00
May Day.	.15½
Opohongo.	.01
Prince Con.	.40½
Seven Troughs.	.01½
Silver King Coal'n.	3.07½
Silver King Con.	1.87½
Sioux Con.	.03
Uncle Sam.	.04
Yankee.	.01

TORONTO May 29

Bailey.	.02	Dome Exten.	.10
Coniagas.	.04¾	Foley O'Brien.	.30
Peterson Lake.	.24	Hollinger.	25.75
Right of Way.	.03	Imperial.	.06
Seneca Superior.	1.12½	Jupiter.	.10
Silver Queen.	.01	McIntyre.	.40
T. & Hudson Bay.	‡20.00	Pearl Lake.	.01
Timiskaming.	.31	Porcu. Crown.	.80
Wettlaufer-Lor.	.03	Preston E. D.	.02
Big Dome	14.25	Rea.	.10

SAN FRANCISCO June 1

Comstock Stocks.		Misc. Nev. & Cal.	
Alta.	‡.04	Belmont.	4.40
Andes.	.05	Jim Butler.	.75
Belcher.	‡.13	Lone Star.	‡.07
Best & Belcher.	.05	MacNamara.	.03
Caledonia.	‡.20	Midway.	.17
Challenge Con.	‡.06	Mont.-Tonopah.	.30
Confidence.	.06	North Star.	.16
Con. Virginia.	.08	Rescue Eula.	.11
Gould & Curry.	.02	West End Con.	‡.74
Hale & Norcross.	.03	Atlanta.	.32
Julia.	‡.01	Booth.	.53
Mexican.	.30	C.O.D. Con.	.04
Occidental.	.79	Comb. Frac.	.09
Ophir.	.11	Jumbo Extension.	1.45
Overman.	.05	Pitts.-Silver Peak.	‡.12
Potosi.	‡.01	Round Mountain.	.41
Savage.	.02	Sandstorm Kendall.	‡.08½
Sierra Nevada.	.06	Silver Pick.	.10
Union Con.	.15	Central Eureka.	‡.14
Yellow Jacket.	.30	So. Eureka.	‡2.25

N. Y. EXCH. May 29

Name of Comp.	Clg.
Amalgamated.	65⅝
Am.Sm.&Ref.,com	65½
Am. Sm. & Ref., pf.	103½
Am. Sm. Sec., pf. B.	82
Anaconda.	31½
Batopilas Min.	1½
Bethlehem Steel.	137
Bethlehem Steel, pf.	112
Chino.	44½
Colo. Fuel & Iron.	30
Federal M. & S., pf.	34½
Great Nor., ore., ctf.	31⅛
Guggen. Exp.	59½
Homestake.	117
Inspiration Con.	29½
Mex. Petroleum	68
Miami Copper.	25⅛
Nat'l Lead, com.	60
National Lead, pf.	109½
Nev. Consol.	15⅛
Ontario Min.	3
Quicksilver, pf.	1½
Ray Con.	23½
Republic I&S, com.	27½
Republic I&S, pf.	83½
SlossSheff'd, com.	32
Tennessee Copper.	32½
Utah Copper.	65½
U. S. Steel, com.	54½
U. S. Steel, pf.	106⅛

N. Y. CURB May 29

Name of Comp.	Clg.
Alaska Juneau, w.i.	13⅛
Alta Con.	.85
Beaver Con.	‡.35
Big Four.	‡.07
Blue Bell.	‡.03
Braden Copper.	7⅛
Buffalo Mines.	1 3/16
Can. Cop. Corpn.	‡11/16
Can. G. & S.	‡.03½
Caribou.	.45
Cashboy.	.08
Chambers Ferland.	‡.17
Con. Ariz. Sm.	.75
Con. Coppermines.	2
Davis-Daly.	‡.99
Diam'field-Daisy.	‡.07
Dia. Black B.	‡.04
Florence.	.55
Goldfield Con.	1½
Goldfield Merger.	‡.25
Greene Cananea.	30
Kerr Lake.	4 1/16
La Rose.	⅛
McKinley-Dar-Sa.	.30
Mines of Am.	2
Nevada Hills.	.21
New Utah Bingham	2½
Nipissing Mines.	5⅛
Ohio Copper.	1/16
Oro.	.09½
South Utah.	‡⅛
Stand'd Oil of N.J.	398
Standard S. L.	1½
Stewart.	1⅛
Tonopah.	6⅞
Tonopah Ex.	3 1/16
Tonopah Merger.	.37
Tribullion.	1⅜
Tularosa.	‡.18½
West End Ex.	.04
Yukon Gold.	2⅛

LONDON May 19

Name of Comp.	£	s	d
Alaska Tre'dwell	7		
Cam & Motor.	0	15	0
Camp Bird.	0	6	0
El Oro.	0	7	3
Esperanza.	0	7	9
Mexico Mines.	3	12	6
Oroville.	0	12	0
Santa Gert'dis.	0	7	6
Tomboy.	1	4	6
Tough Oakes.	0	12	6

BOSTON EXCH May 29

Name of Comp.	Clg.
Adventure.	2½
Ahmeek.	388
Alaska Gold M.	34½
Algomah.	3⅜
Allouez.	54½
Am. Zinc	47½
Ariz. Com., ctfs.	7⅜
Bonanza.	‡.35
Butte-Ballaklava.	3½
Butte & Superior.	70½
Calumet & Ariz.	62
Calumet & Hecla.	585
Centennial.	18
Cliff.	‡1½
Copper Range.	51
Daly West.	2½
East Butte.	11½
Franklin.	9⅜
Granby.	79½
Hancock.	21
Hedley	‡28
Helvetia.	‡.70
Indiana.	7⅜
Island Cr'k, com.	43½
Island Cr'k, pfd.	90
Isle Royale.	27
Keweenaw.	2⅜
Lake.	12½
La Salle.	6⅜
Mass.	13
Mayflower	5
Michigan.	1½
Mohawk.	70
New Arcadian.	8⅜
North Butte.	31
North Lake.	2½
Ojibway.	2⅜
Old Colony.	4½
Old Dominion.	53
Osceola.	79½
Quincy.	87½
Santa Fe.	2⅜
Shannon.	8½
Shattuck-Ariz.	27
Superior.	27½
Superior & Bost.	3⅜
Tamarack.	34
Trinity.	4½
Tuolumne.	.40
U. S. Smelting.	35½
U. S. Smelt'g, pf.	44
Utah Apex.	3 5/16
Utah Con.	13½
Victoria.	3
Winona.	4
Wolverine.	56
Wyandot.	1⅜

BOSTON CURB May 29

Name of Comp.	Bid.
Alvarado.	‡.65
Bingham Mines.	.06½
Boston Ely.	.30
Butte & Lon'n Dev.	‡.17
Calaveras.	2
Calumet-Corbin.	.09
Chief Con.	.85
Corbin.	.90
Cortez.	.20
Crown Reserve.	.75
Eagle & Blue Bell.	1½
First Nat. Cop.	2
Houghton Copper.	4⅜
Iron Cap Cop., pf.	5
Majestic.	.55
Mexican Metals.	.16
Nevada-Douglas.	.65
New Baltic.	3½
Oneco.	1⅞
Raven Copper.	.10
Smokey Dev.	.35
So. Lake.	6⅜
Tonopah Victor.	‡.31
Trethewey.	‡.14
United Verde Ext.	4½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January.	62.938	57.572	48.855	28.983	26.553	22.731
February.	61.642	57.506	48.477	28.357	26.573	22.753
March.	57.870	58.067	50.241	26.669	26.788	23.708
April.	59.490	58.519	50.250	27.416	26.958	23.709
May.	60.361	58.175	49.915	27.825	26.704	23.570
June.	58.990	56.471	.....	27.199	25.948	.....
July.	58.721	54.678	.....	27.074	25.219	.....
August.	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October.	60.793	50.654	.....	28.083	23.199	.....
November.	58.995	49.082	.....	27.263	22.703	.....
December.	57.760	49.375	.....	26.720	22.900	.....
Year.	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January.	14.223	13.641	64.304	60.756	69.488	65.719
February.	14.491	14.394	65.259	63.494	70.188	*
March.	14.131	14.787	64.276	66.152	69.170	*
April.	14.211	16.811	64.747	75.069	69.313	*
May.	13.996	18.506	63.182	77.600	67.786	*
June.	13.603	.....	61.336	.....	66.274	.....
July.	13.223	.....	60.540	.....	64.955	.....
August.	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October.	*	.....	‡	.....	‡	.....
November.	11.739	.....	53.227	.....	*	.....
December.	12.801	.....	56.841	.....	*	.....
Year.	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January.	37.779	34.260	171.905	156.550
February.	39.830	37.415	181.556	176.925
March.	38.038	48.426	173.619	180.141
April.	36.154	47.884	163.963	166.225
May.	33.360	38.790	150.702	162.675
June.	30.577	.....	138.321	.....
July.	31.707	.....	142.517	.....
August.	*	.....	‡	.....
September	32.675	.....	‡	.....
October.	30.284	.....	‡	.....
November.	33.304	.....	139.391	.....
December.	33.601	.....	147.102	.....
Av. year.	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	4.111	3.729	4.011	3.548	19.665	18.606
February.	4.048	3.827	3.937	3.718	19.606	19.122
March.	3.970	4.053	3.850	3.997	19.651	21.883
April.	3.810	4.221	3.688	4.142	18.225	21.094
May.	3.900	4.274	3.808	4.182	18.503	20.347
June.	3.900	.....	3.810	.....	19.411	.....
July.	3.891	.....	3.738	.....	19.051	.....
August.	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October.	3.528	.....	3.384	.....	‡	.....
November.	3.683	.....	3.585	.....	18.500	.....
December.	3.800	.....	3.662	.....	19.097	.....
Year.	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January.	5.262	6.386	5.112	6.211	21.533	30.844
February.	5.377	8.436	5.228	8.255	21.413	39.819
March.	5.250	8.541	5.100	8.366	21.460	44.141
April.	5.113	10.012	4.963	9.837	21.569	49.888
May.	5.074	14.781	4.924	14.610	21.393	68.100
June.	5.000	.....	4.850	.....	21.345	.....
July.	4.920	.....	4.770	.....	21.568	.....
August.	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October.	4.909	.....	4.750	.....	‡	.....
November.	5.112	.....	4.962	.....	25.016	.....
December.	5.592	.....	5.430	.....	27.369	.....
Year.	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January.	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February.	15.06	14.55	14.12	13.45	14.08	13.90
March.	15.07	14.55	13.94	13.45	14.10	13.95
April.	14.90	14.55	13.90	13.45	14.13	13.95
May.	14.90	14.61	13.90	13.60	14.27	13.83
June.	14.90	.....	13.90	.....	13.96	.....
July.	14.90	.....	13.90	.....	13.90	.....
August.	14.90	.....	13.90	.....	14.08	.....
September	14.90	.....	13.90	.....	14.03	.....
October.	14.84	.....	13.75	.....	13.97	.....
November.	14.59	.....	13.43	.....	13.83	.....
December.	14.70	.....	13.45	.....	13.83	.....
Year.	$14.88	.....	$13.78	.....	$14.01	.....

The Mining Index

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COPPER

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1125—COAL-DUST FIRED REVERBERATORY FURNACES. (Bull. A. I. M. E., May, 1915; 12½ pp.) Discussion of paper by D. H. Browne, previously indexed.

1126—CRUSHING PLANT of the Ohio Copper Co.'s Mill. Robert S. Lewis. (Eng. and Min. Journ., Apr. 24, 1915; 1½ pp., illus.) 20c.

1127—FLOTATION of Copper Ores. (Min. and Sci. Press, May 1, 1915; 2 pp. 20c.

1128—LEACHING—Efficiency of Acid in Copper Leaching. Oliver C. Ralston and D. A. Lyon. (Salt Lake Min. Rev., Apr. 30, 1915; 1 p.) 20c.

1129—LEACHING—New Anaconda Leaching and Acid Plants. E. P. Mathewson. (Eng. and Min. Journ., Apr. 24, 1915; 4½ pp., illus.) 20c.

1130—LEACHING—Simple and Efficient Precipitant for Copper from Acid Solutions. Wm. Thompson. (Min. and Eng. Wld., May 1, 1915; ¾ p.) 20c.

1131—LEACHING—Solution Control in Ferric-Chloride Leaching of Sulphide Copper Ores. F. N. Flynn and Roger H. Hatchett. (Met. and Chem. Eng., May, 1915; 1 p.) 40c.

1132—MICHIGAN—Copper Mining in Michigan. Thomas T. Read. (Min. Mag., Apr., 1915; 5 pp., illus.) 60c.

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1135—NORWAY—The Grong Copper and Pyrites Mines of Norway. Andreas Dahl Udhany. (Eng. and Min. Journ., May 22, 1915; 3¼ pp., illus.) 20c.

1136—ORE DEPOSITION—On Temperatures that Obtain in Zones of Chalcocitization. W. H. Emmons. (Econ. Geol., Feb.-Mar., 1915; 9½ pp.) 60c.

1137—PRODUCTION of Copper in the United States in 1914. B. S. Butler. (Advance statement, U. S. Geol. Surv., 1915; 4 pp.)

1138—REFINING—Waste-Heat Boilers at Chrome, N. J. Clarence L. Brower. (Eng. and Min. Journ., May 22, 1915; 2¾ pp., illus.) Describes installation of two 250-hp. vertical Cahall boilers installed on 75-ton reverberatory refining furnace; the installation was not successful. 20c.

1139—SMELTING of Copper Ores in the Electric Furnace. Dorsey A. Lyon and Robert M. Keeney. (Bull. 81, U. S. Bureau of Mines, 1915; 80 pp.)

1140—WAR—The Position of Copper During the War Period. John B. C. Kershaw. (Engineer, May 7, 1915; 1 p., illus.) 40c.

GOLD AND SILVER—GEOLOGY

1141—ALASKA—Geology of Juneau District. (Eng. and Min. Journ., May 22, 1915; 1¼ pp.) From a paper by F. B. Hyder before Min. and Eng. Soc. of Alaska. 20c.

1142—ASHANTI—Notes of Some Gold Occurrences in Ashanti. J. Morrow Campbell. (Bull. 127, I. M. M., Apr. 8, 1915; ½ p.) Further contributed remarks on paper previously indexed; also author's reply to discussion.

1143—YUKON TERRITORY—The Geology and Economic Minerals of Yukon Territory. Erle Chadwick Annes. (Mine, Quarry and Derrick, Apr. 14, 1915; 5 pp.) 40c.

GOLD DREDGING AND PLACER MINING

1144—ALASKA—Yakataga Beach Placers. Arthur G. Thompson. (Eng. and Min. Journ., May 1, 1915; 2½ pp., illus.) 20c.

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GOLD AND SILVER CYANIDING

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1154—PRECIPITATION—The Precipitating Action of Carbon in Contact with Auriferous Cyanide Solutions. W. R. Feldtmann. (Bull. 127, I. M. M., Apr. 8, 1915; 15 pp.)

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GOLD AND SILVER—GENERAL

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1159—ALASKA GASTINEAU MILL. L. E. Spray. (Min. and Sci. Press, Apr. 17, 1915; 2¾ pp., illus.) 20c.

1160—ARIZONA—The Tom Reed-Gold Road Mining District, Mohave Co., Ariz. (Folder issued by Tom Reed-Gold Road Assn., Los Angles, Calif., 1915.) Gives a map of the district and list of the operating companies.

1161—CHILE—Gold and Silver in Chile. Mark R. Lamb. (Eng. and Min. Journ., May 15, 1915; 3 pp., illus.) A short description of the various operating gold and silver mines of Chile. 20c.

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1165—PORCUPINE DISTRICT—Metallurgical Practice in the Porcupine District. (Bull. A. I. M. E., May, 1915; 1¾ pp.) Discussion of paper by Noel Cunningham, previously indexed.

1166—REFINING GOLD BULLION—Presidential Address by Sir Thomas Kirke Rose. (Bull. 127, I. M. M., Apr. 8, 1915; 21 pp.)

1167—TUBE MILLING—The Theory of Tube-Milling. H. A. White. (Journ. Chem., Met., and Min. Soc. of So. Afr., Feb., 1915; 18½ pp., illus.)

IRON ORE DEPOSITS, MINING, ETC.

1168—CONCENTRATION TESTS—Preliminary Concentration Tests on Cuyuna Ores. Wm. R. Appleby and Edmund Newton. (Bull. 3, Minn. School of Mines, Experiment Sta., 1915; 66 pp., illus.)

1169—ORE DEPOSITS—The Formation and Distribution of Residual Iron Ores. C. L. Dake. (Bull. A. I. M. E., May, 1915; 9½ pp.) 40c.

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IRON AND STEEL METALLURGY

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1189—VANADIUM IN STEEL—A Simplified Ferrous Sulphate Method for the Determination of Vanadium in Steel. Geo. T. Dougherty. (Journ. Ind. and Eng. Chem., May, 1915; ¾ p.) 60c.

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LEAD AND ZINC

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1192—DESILVERIZATION—Effect of Zn_3Ag_2 upon the Desilverization of Lead. (Bull. A. I. M. E., May, 1915; 3 pp.) Discussion of paper by F. C. Newton, previously indexed.

1193—GALENA ORES—On the Occurrence of Silver in Argentiferous Galena Ores. Arvid E. Nissen and Samuel L. Hoyt. (Econ. Geol., Feb.-Mar., 1915; 9½ pp., illus.) 60c.

1194—PRODUCTION of Lead in the United States in 1914. C. E. Siebenthal. (U. S. Geol. Surv., 1915; 8 pp., illus.)

1195—TENNESSEE—Zinc Deposits of Eastern Tennessee. Frank L. Nason. (Eng. and Min. Journ., Apr. 24, 1915; 2 pp.) 20c.

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